

WU  
H349s  
1890

*across*

SURGEON GENERAL'S OFFICE

LIBRARY

Section

*Sec 11*

ANNEX

Form 113c  
W. D., S. G. O.

No.

*291865*

GOVERNMENT PRINTING OFFICE

THE  
STUDENT'S MANUAL

AND  
HAND-BOOK  
FOR THE  
DENTAL LABORATORY.

SECOND EDITION.

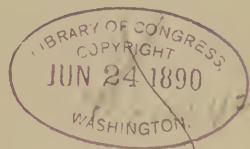
BY  
L. P. HASKELL,

PROFESSOR OF PROSTHETIC DENTISTRY, DENTAL DEPARTMENT OF THE NORTH-  
WESTERN UNIVERSITY, CHICAGO.

To which is appended Dr. E. H. Angle's System of Appliances for  
Correcting Irregularities.

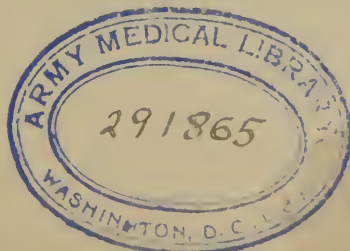
---

PUBLISHED BY  
THE WILMINGTON DENTAL MFG CO.,  
PHILADELPHIA  
1890.



---

Copyright 1890, by The Wilmington Dental Mfg Co, Philadelphia.



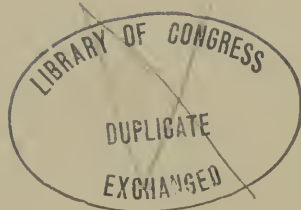
Anney

WL

H349s

1890

Feb 22/4 2d



## PREFACE TO FIRST EDITION.

---

AT the urgent advice of members of the profession, I have prepared this work, for which there seems to be a place in the laboratory of the young dentist, to say nothing of the older members of the profession, who, in these days of rubber plates, have had little experience in metal work.

The text-books are too diffusive, embodying too many methods for the same object, confusing to the student, and inconvenient as hand-books.

This book will embody the result of forty years' experience in the dental laboratory and exclusive attention to prosthetic dentistry, furnishing methods which have been thoroughly demonstrated as simple and effective, producing satisfactory results.

It is not intended to take the place of the text-book in the dental college, though the student will find it there a valuable aid in the prosecution of his preparatory work.

## PREFACE TO SECOND EDITION.

---

FOR the flattering reception the first edition of this work received at the hands of the Dental Journals, and the profession at large, I desire to return my thanks.

Suggestions from several sources as to additional illustrations have been heeded.

My reason for including in this work Dr. E. H. Angle's system of appliances for correcting irregularities is, that it is the most simple, and at the same time effectual, of any thing that has been devised, avoiding plates and ligatures, occupying but little room in the mouth, unintermittent in its operation, and requiring no additional appliances for retaining purposes. Dr. Angle has re-written and largely illustrated his work.

The suggestion has been made that I embody a chapter on crown and bridge-work.

This covers so broad a field, with such an infinite variety of methods, and constantly increasing, that a work devoted to this subject is necessary, and such a one has already been prepared by Dr. George Evans.

# CONTENTS.

General Principles.....	5
The Laboratory.....	6
Tools and Appliances.....	8
Blow-pipe, etc.....	9
Impressions.....	12
Plaster Casts.....	14
Dies.....	17
Swaging Plates.....	20
Fitting Plates.....	23
Clasps.....	24
Investing, Backing, Soldering.....	26
Preparation of Metals and Making Solders.....	29
Attachment of Teeth to Plates.....	31
Relative Value of the various Materials for Plates.....	32
Combination Work.....	33
Continuous-Gum.....	35
Cast Metal Plates.....	43
Vulcanized Rubber.....	45
Celluloid.....	48
Repairing.....	49
Selection and Arrangement of Teeth.....	51
Temperaments.....	54
Temporary Work.....	64
Adjustment in the Mouth.....	65
The Angle System of Regulation and Retention of Teeth.....	67
Fractures of Maxillary Bones.....	90



## CHAPTER I.

### GENERAL PRINCIPLES.

IN examining the mouth for the insertion of an artificial denture, there should be taken into account all its conditions, viz.: the shape of the jaws, long or short, deep or shallow, hard and unyielding, soft and yielding; a solid, alveolar ridge, or one from which the bone has been absorbed, leaving a flexible condition; the relative position of the jaws, whether the lower is receding or protruding; and then the remaining teeth, if there are any; for often a few teeth are left, sometimes useful; but often not only useless, but interfering with the comfort and usefulness of the artificial denture. If the patient is better off without them, advise their extraction.

The first object to be attained is comfort and usefulness; next, artistic appearance, or resemblance to nature, not only in the size, shape, color, and arrangement of the teeth, but in forming the artificial gum, be it rubber or porcelain, so as to restore the contour of the lips.

The selection of material for plates the patient should leave to the dentist, presuming he has been properly educated as to the relative value of each. Whatever materials and methods will secure the best results should be adopted.

The remark is often made, "I do not have any demand for metal plates." That is true, in consequence of the universal use of rubber; consequently you must create the demand by showing your patients the superiority of the metal, and the disadvantages of the rubber.

## CHAPTER II.

### THE LABORATORY.

IT should not be a *machine* shop, but adapted to, and arranged for, the object intended.

It should be large enough for all the purposes of a dental laboratory, well lighted, and easy of access from the operating-room.

The work-bench should be in front of the window, as it is difficult to work advantageously by a side light. The bench should be of hard wood, about 18 inches wide,  $1\frac{1}{2}$  inches thick, and of a proper height to sit down and work at easily.

The gold drawer should be 2 feet long, 18 inches wide, 6 inches deep, with the front cut out in a half circle, so as not to be in the way in filing. In it should be a "gold-pan,"  $14 \times 10$ , and  $1\frac{1}{2}$  inches deep, with a top depressed in the centre, and perforated with small holes for the filings to pass through. There should be a hard-wood knob in the bench over the drawer to file on. If there is plenty of room, a second drawer with knob, for rubber-work, is desirable; also a drawer for refuse wax, and over which to "wax-up."

The *plaster-bench* should be constructed with a hole in the centre, for refuse plaster to drop through into a box or barrel; shelf for flasks, and a tin can for plaster.

The *molding-box* may be 18 inches square and 4 inches deep, placed as a permanent fixture, with shelves for flasks, dies, etc.

The lathe should be a permanent fixture on a bench, with good light, and sufficiently high to stand at. A machinist's lathe is not adapted for *dental* purposes, while we have dental lathes admirable in all their appointments. Have a rack for the appliances.

The tools should be arranged at the back of the bench, within easy reach, and never in a drawer. Have in the rack only such as are needed for dental purposes, laying duplicates aside.

A *movable swaging-block* (Fig. 1), to be kept under the bench, by the side of the gold-drawer, is made as follows: 8 inches wide at the top, and 11 inches at the bottom, just high enough to pass under the bench. Make it of pine, with a plank bottom, to which attach heavy castors, a handle on one side, and a pocket for the hammer. Have an iron six inch cube cast, and nearly filling the box full of saw-dust, place the cube in it so it will extend 2 inches above the box.

If you intend to make Continuous-gum work, provision should be made for a furnace.

FIG. 1.



MOVABLE SWAGING-BLOCK.

## CHAPTER III.

### TOOLS AND APPLIANCES.

DENTAL depots are filled with appliances, many useless, others sometimes useful, but not necessary. The following are indispensable:

#### FOR METAL WORK.

Straight Shears, with openings for the fingers.	Plate Nippers.
Plate punch.	Pliers, cutting.
Hammer, for swaging.	Pliers, round-nosed.
Horn or wood mallet.	Pliers, flat-nosed.
Files, round and half round.	Hammer, riveting.
Small vise and anvil.	Plate burnisher, flat.
Slate, for borax.	Tweezers, for solder, etc.
Sheet-iron soldering pan.	Reamer, for countersink.
Articulators.	Blow-pipe, mouth.
Lathe appliances.	Carbon or asbestos soldering-block.
Felts and brushes for polishing.	Lathe, cone-bearing.
Acid dish, <i>lead</i> .	Circular saw, large and small burs, and drills
Sieve.	Two ladles.
Molding flask, 5 in. diameter, 3 in. deep, of iron.	Stick for packing.
Plate Benders (lower.)	Two sizes of rings for counter dies.
Gas-pipe, so arranged as to be used for soldering, "waxing up," vulcanizing and melting metals.	

#### FOR RUBBER WORK.

Vulcanizer.	Bowls, medium size.
Wrenches.	Shellac bottle (wide mouth).
Scraper, round shape.	Flasks.
Chisel, with thin edge, for trimming around necks of teeth.	Press.
Small pointed instruments for finishing between the teeth.	Calipers.
Saw-frame and saws.	Files, two grades.
An instrument for waxing up, straight and pointed at one end, and slightly curved at the other (Fig. 12).	Plaster-knife.
	Heavy tea or dessert spoons for mixing and handling plaster.
	Oil bottle.

## FOR CELLULOID.

All tools used for rubber except vulcanizing flasks and press, substituting celluloid flasks and press.

---

## FOR CONTINUOUS GUM.

Furnace.	Muffles, slides, tongs, and poker.
Porcelain Boxes, for mixing material.	Camel hair pencils.
Instrument for applying material.	Stiff Brush.

---

## TO THE ABOVE CAN BE ADDED:—

Automatic blow-pipe.	Rolling Mill.
Furnace, or melting apparatus.	Tongs for crucible.
Ingot Mold.	Plate gauge.

## BLOW-PIPE, ETC.

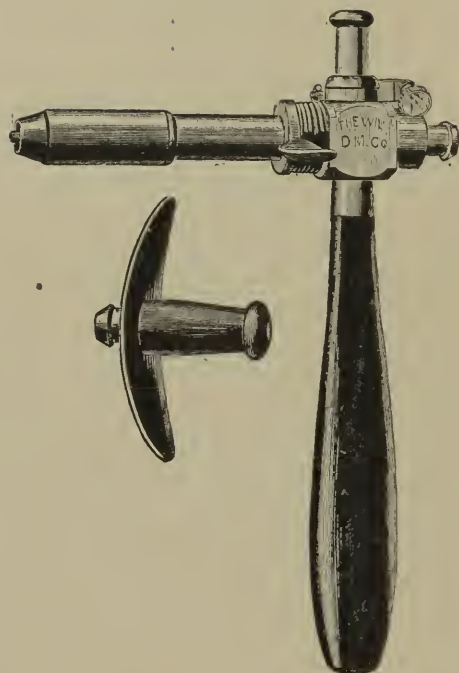
Every student should learn to use the mouth blow-pipe.

The first thing to be done is to secure a proper blow-pipe. Those usually sold at the depots are made for jewelers, who solder small objects with a low grade of solder, and not invested as teeth are. The Wilmington Dental Manufacturing Company have blow-pipes made at my suggestion. The mouth aperture is  $\frac{5}{8}$ , and the small one 1-16 inch.

The end should not be taken between the lips, as it tires the muscles too much, but pressed against them. There must be a supply of air in the lungs constantly, so do not allow a complete collapse of the diaphragm, at the same time pressing the tongue against the palate to prevent the lips collapsing while drawing in a fresh supply through the nose. A little practice, observing these rules, will soon enable one to use it successfully.

The automatic blow-pipe, operated by foot bellows, is useful in the laboratory. There are two very desirable ones, one of which is Dr. L. M. Matthew's "Little Giant," manufactured by The Wilmington Dental Manufacturing Company. (Fig. 2). The other is manufactured by The Buffalo Dental Manufacturing Company, known as No. 6F.

FIG. 2.



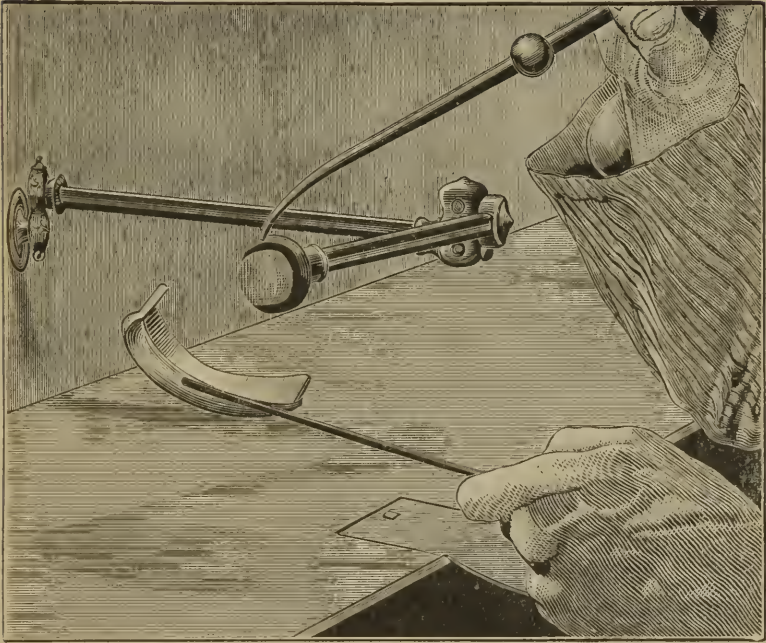
DR. L. M. MATTHEW'S "LITTLE GIANT BLOW-PIPE."

The proper gas-jet for soldering is a wire bulb, made by leaving the end of the gas-pipe with no burner and winding over it fine binding-wire, till a bulb about one inch in diameter is secured; the same results may be obtained by making a bulb of several thicknesses of fine wire-gauze over the end of the pipe, and bound tightly to it. The McIntosh Battery Company, Chicago, have recently, at my suggestion, made a wire gauze burner that can be screwed to the gas-pipe.

The object is to break the force of the gas, and add more oxygen to it; in this way, a flame like an alcohol lamp is secured, which can be easily controlled by the blow-

pipe, and in heating up, the whole flame can be taken within its scope. The gas fixture should be horizontal, with two lengths, so as to place in the most convenient position while using.

FIG. 3.



USING BLOW-PIPE, AND SHOWING BURNER AND SOLDERING-PAN.

## CHAPTER IV.

### IMPRESSIONS.

THE success of the artificial denture depends on a correct impression as the foundation for the work, therefore care should be taken to insure success. As to materials, I differ with many instructors. In some cases, good impressions can be taken in wax, more in the modeling compound, but plaster is a material always to be relied on. It may be accepted as an axiom that the more difficult the case to obtain an impression of, the greater need of plaster.

For a *Full Upper*, spread a large napkin over the dress; select a cup as near the size of the jaw as possible; as it is necessary to obtain a high impression over the cuspids, place a little wax over the outside of the cup at those points, also over the posterior corners, if the tuberosity is deep, and raise the palatal surface at the rear a little if the arch is deep.

Mix the plaster to the consistency of thick cream, and add a pinch of salt, at the last moment, after the plaster is ready, as you do not want to hasten the setting till after placing in the mouth; stand at the right side, and with the left hand distending the lips, press the rear of the cup into place, and so, forcing any excess forward, press the cup into place, at the same time telling the patient to "keep the tongue quiet, and not to be concerned about what runs over at the rear," then pressing the lip so as to force the plaster well up under it. If there is nausea, tell the patient to *resist* the tendency, as it will be over in a few moments. As soon as the plaster has set, which can be ascertained by breaking off a piece of the surplus in front, remove by raising the lip high, and working the impression so as to let in the air.

For a *Full Lower*, proceed as above, only standing *in front* of the patient, and as the cup is passed into place, press

the cheeks away from the cup, so there shall not be a fold of membrane underneath.

For a *Partial Lower*, with the anterior teeth remaining, select a cup with an opening for the teeth, and through which they will pass easily. Wet a piece of paper and lay over the opening, and, holding the cup in the palm of the hand, put in the plaster, and place in the mouth, always pressing away the plaster from the front before inserting, so as to have as little outside of the teeth as possible, as it will facilitate its removal. If there are molars remaining, so that the sides of the cup will not go deep enough, place wax on the outer edges. Sometimes the teeth stand in such a position that the plaster must, of necessity, break; this is of little importance, as the pieces will readily go together again.

For a *Partial Upper*, proceed as with a full upper, only, before inserting, press away the plaster from the sides of the cup where there are teeth, as there will be enough to go outside. *Do not let the plaster set as hard* as in full cases, or the cup will leave the impression, and the plaster have to be broken away in pieces. This can always be avoided, and should be, as it is very unpleasant for the patient.

Never take an impression in wax, and then plaster in it; for while the plaster will break just the same, it will often be difficult to replace, or even save the pieces, when they are thin; there is nothing to be gained by it. Be sure your impression is good before dismissing the patient. It is a simple process, only avoid using an excess of plaster, and too large a cup.

## CHAPTER V.

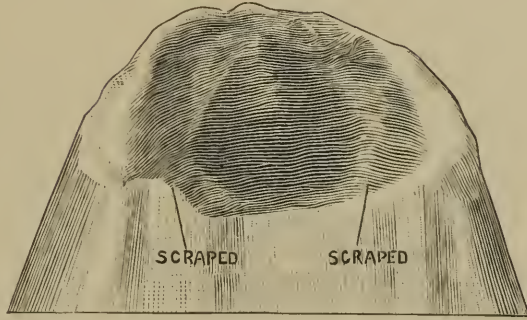
### PLASTER CASTS.

WHILE there are various methods of preparing the impression, I much prefer shellacing, always using it thin, so it will strike in, and not make a skin on the surface. By shellacing it is easy to tell what is cast and what is impression, when separating. Next, oil lightly, and turn the impression *face down* while mixing the plaster. Mix the plaster the same as for the impression, about the consistency of thick cream; place but little in the impression at first, and jar thoroughly so as to drive out all air. When hard, remove the cup, and with a sharp knife pare the impression to near the teeth, if there are any, or to the cast. With a blunt-pointed knife, proceed to break it away, beginning at the heel and pressing with the thumb to guard against the knife going into the cast.

*For a full upper*, make the following changes in the cast. In most cases, the palate is hard in the centre, and as the rest of the surface will yield invariably to pressure, the plate will bear hard and irritate, and rock. Therefore relief should be provided by raising the plate where the palatal bone is hard. If it is to be a rubber plate, scrape a portion from the plate when finishing. For a metal plate, it is better to raise with a *thin* film of wax along the entire hard palate, about  $\frac{1}{32}$  inch in depth, graduating to the edges so as to show no line. The amount of surface thus covered will vary in different mouths; some quite wide, others narrow. At each side of the hard palate, at the posterior edge of the plate, *scrape* the cast slightly, so the plate will hug snugly there

(Fig. 4). If there is a *flexible* ridge in front, its normal condition is where the plate which has been worn has pressed it, and there it should remain, for no change of position will improve it; it would be better if the patient would submit to its removal.

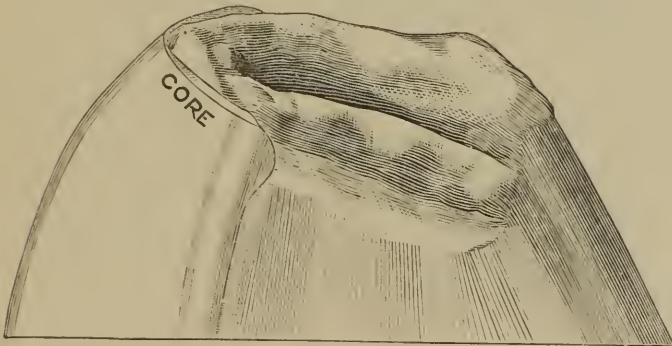
FIG. 4.



*No air chambers* are needed in full plates. If the plate comes in close contact with the membrane, there will be all the adhesion necessary to sustain the heaviest work.

Mix plaster, spread on a smooth surface, and set the cast into it, so as to make the whole about  $1\frac{1}{2}$  inches high; if the cast is *slightly* under-cut, *raise the front* a little, and then form the plaster around the sides so as to have them flaring. The object is to facilitate the removal of the cast from the mold, as it will deliver itself better than if removed with the fingers.

FIG. 5.



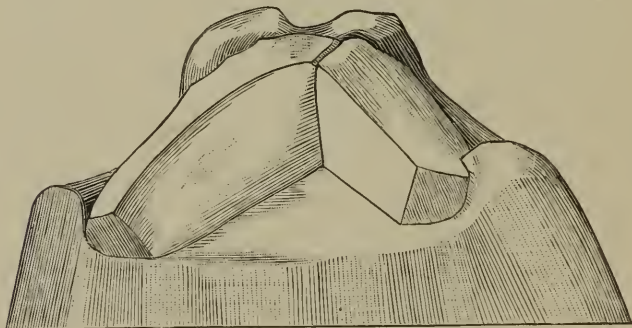
If the case is badly *undercut*, either in front or at the posterior corners, make a "core" (Fig. 5) as follows: Set the

cast, after it is ready for molding, on a smooth surface; oil the surface, where undercut; mix plaster and asbestos, equal parts, and lay on the surface  $\frac{1}{4}$  inch wide at the base, up to the top of the cast; when hard, remove, trim, and dry perfectly for molding.

For *full lower*, prepare for molding as above, having, previously to filling the impression, *removed a little from the surface of it, in the extreme depression*, or what represents the summit of the jaw, so the plate will set more easily.

If the *lower case*, either full or partial, is badly undercut, make a "core," in two sections, one transversely across the heel to past the cuspid, and the other to lap on to this one (Fig. 6). In this way a perfect die may be obtained.

FIG. 6.



If it be a *partial lower*, leave the anterior teeth on the cast, building up with plaster against the front to have the cast flare, cutting off all other teeth from the cast.

For *partial uppers* cut off all teeth. If for *suction*, relieve the hard center, as in full sets; or if deemed best, put in an "air-chamber." Some patients will wear a plate without, others will think they cannot.

## CHAPTER VI.

### DIES.

THE qualities requisite for a dental die are these: *non-shrinking* ; *hard*, so as not to batter in swaging ; *cohesive*, so as not to break ; furnishing a *smooth surface* ; *fusing at a low temperature*.

Babbitt metal is the only alloy that furnishes all of these qualities. My use of it for thirty-five years has fully demonstrated its complete adaptability to this use. But as there are many formulas, it is important to have one suited to this purpose. This is: copper, one part ; antimony, two parts ; tin, eight parts. These should be melted in the order named, as tin would oxidize badly before the first was melted if all were placed in the crucible together. As a strong heat is required, it is well to use a furnace, or a blacksmith's forge. Melt and turn off into ingots, and re-melt. Babbitt, made from this formula, can be had of the leading dental supply manufacturers. If it should not be found to run freely from the ladle, when making a die, add some tin.

*For Counter Dies.* As lead fuses at a higher temperature than Babbitt, and would adhere to it when poured on it, reduce the melting temperature by the addition of tin,—five parts lead, one part tin ; this also hardens it, which is an advantage, as lead is too soft for the counter die.

The use of *oiled* sand is of great advantage, because it can be used many times without re-oiling, when properly prepared, avoids bubbling and other delays incidental to wetting sand, and can be packed harder.

Use sweet oil, making the sand of the same consistency as when wet. If too much is in, add more sand. Avoid the use of sand which is *very* fine.

The molding-box, ring, and flasks have been described in a previous chapter (II). It is necessary to sift the sand

only after using several times, and then only on the surface of the model. Pack hard at first around the sides, so the sand will not drop out of the ring, and then gradually adding and packing till full. In most cases, the model will drop when lifting the mold. If it does not, jar the edge of the ring on the edge of the molding-box. A potato-masher is well adapted for packing the sand, using the small end for the sides, and large end for the top.

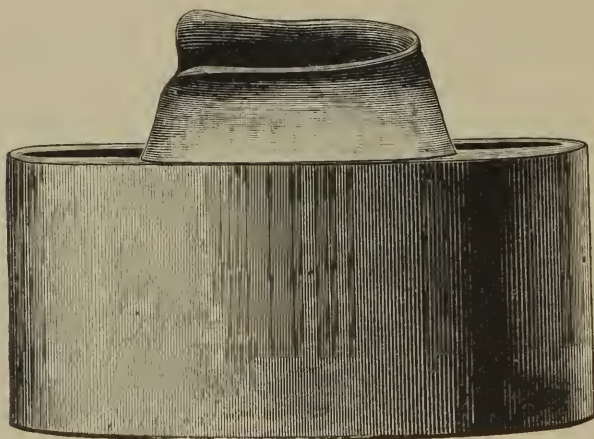
It is a good plan to rub pulverized soap-stone on the model before molding, especially when the sand is first used.

Melt the Babbitt, and do not pour when very hot, but stir till it has cooled a little, so it will not burn the sand much.

Be careful not to injure the metal by over-heating it. Do not cool the die suddenly in water, as it tends to make it brittle.

After it is cool, coat with whiting, wetting and rubbing it on with the finger. Set it into the sand *half* its depth; place a small ring or flask around it (Fig. 7); melt the lead

FIG. 7.



DIE READY FOR CASTING THE COUNTER.

and turn, but do not fill the ring full, leaving space to grasp it with pliers, and plunge into water. It is never necessary to swage in the ring.

In molding an *under-cut* case, put the "core" carefully in place, and mold as before; the whole will drop out; replace carefully the core, and pour the metal.

When cores are needed at the posterior corners, or in lower cases, *before making the counter die* pack a little sand into the undercut, so the die and counter will separate; then, after the plate has been swaged as far as the counter will permit, bring the plate into place in the under-cut with the flat burnisher, or, if necessary, with a round faced hammer.

It is sometimes necessary to make a second die, but not generally where Babbitt is used.

If the case has a deep arch, make a *half* counter, just filling the arch, and not extending on the ridge; by so doing there is less danger of tearing the plate in the arch, when swaging.

The use of Babbitt metal for dies very greatly simplifies the making of metal plates.

## CHAPTER VII.

### SWAGING PLATES.

CUT a pattern for the desired plate; for this there is nothing so good as Japan tea-chest lead; it is thicker and stronger than the Chinese.

The grain of the plate should always be *crosswise* of the die, as in the swaging there is far less danger of its tearing, and, of course, is stronger in wear.

Oil the dies to prevent, as far as may be, base metal from adhering to the plate; if metal adheres, wipe it off, as it will eat into the plate when heating.

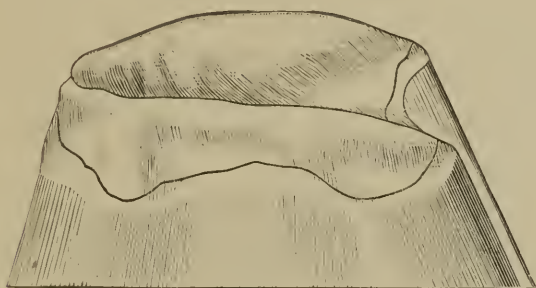
Anneal by heating to redness; as the surface oxidizes, clean by dropping while hot into equal parts sulphuric acid and water. For an acid *dish* there is nothing so good as *lead*; it is easily made by forming it of thick sheet lead, over anything of proper size, about 4 inches diameter, 1 inch deep, with a handle cut in the same piece. Sulphuric acid can be boiled in these, and they will last for years.

If the case is a *full upper*, use the mallet in the arch, and if deep, swage with the *half* counter; the bending pliers (lower always) will be found of value in shaping the ridge; to save time, and against which there is no possible objection, cut the edge of the plate in front, *lap*, and, after fully swaging, solder. If the plate is soft, like 20 karat, or platinum, twice annealing is sufficient, ordinarily; always cleanse in the acid *after* annealing. There is danger of *over-swaging*.

If the case is *under-cut*, after full swaging place on the plaster cast, and burnish into the depression more fully. With the Babbitt metal die it will be seen that the plate fits the plaster cast snugly, so much so that sometimes it will not come full up to the cast in the centre; it will, however, come to its bearings at that point in the mouth.

To aid in restoring the contour of the lip, trim always so as to have the highest points over the cuspids, but drop suddenly back of those points so as to give free play to the muscles. (Fig. 8.) The plate can seldom be worn as high

FIG. 8.



as the impression indicates back of these points, but leave the plate high enough, so that on trying in, it can be trimmed as desired. Be sure there is room for the frænum by cutting or filing an opening for it. Always extend the plate over the maxillary tuberosities, however large, as it aids in keeping the plate in place, preventing its slipping forward.

The edge of a plate should never be swaged to form a "rim," because the edge should be left for trimming by the mouth. If a rim or binding is needed, solder one on; it is easily done, and looks better.

It is best not to solder a wire or rim to a lower plate, either full or partial, because it is often necessary to alter the margins. If it is a gold plate, it should be a rubber attachment, and this makes a good finish to the margins. If continuous gum, double the edge all around  $\frac{1}{8}$  inch wide. Then, if alterations are needed, the appearance of the work is not marred.

In swaging a *lower plate*, use the bending pliers first. If the gum is flat, double the plate about 1 inch in the center.

In trimming a lower plate, it should be remembered that much trouble arises from its being made too deep, so as to infringe on the muscles and loose integuments. The plate is thus lifted by them, and they in return are irritated by the plate.

In swaging a *partial lower*, the plate should be swaged in two pieces, as it facilitates the process, and doubles it where needed. Cut each pattern so as to extend from the posterior to  $\frac{1}{2}$  inch beyond the cuspid, or bicuspid, if any remain. Always carry the plate *above the necks* of the teeth, about half way, as often the attachment of the muscles is so high it necessitates making the plate very narrow, unless it is carried higher, and it will set firmer for so doing.

Swage each piece separate, and then swage together; putting borax between, clamp with small wire clamps (hair-pins make good ones); one of the pieces will usually overlap the other, or if it does not, both may need trimming; trim *one*, leaving the overlap on the other till after soldering, so as to lay the solder on the overlap, drawing through till it can be seen on the other edge.

In swaging a *partial upper*, use the mallet first, and the bending pliers if needed.

If it is to be a clasp-plate, extend the plate  $\frac{1}{4}$  inch beyond the tooth to be clasped, as the plate will set steadier. Double around weak points, either each tooth separately, or in one piece  $\frac{1}{4}$  inch wide around the whole plate, laying the solder on the overlapping points, and drawing through; if laid on the inner edge, there is danger of flowing it on the plate. It is never well to double the whole width of plate.

## CHAPTER VIII.

### FITTING PLATES.

IN the full upper plate, see that it sets steady. If the ridge is flexible, it must inevitably yield to pressure. The point of great importance in securing suction is at the posterior margin, in the centre. See that it sets close enough to exclude the air. This can be done by wetting it before placing in the mouth, and then by a pumping process, watching for the escape of air-bubbles; if any appear, place on the model and burnish closer. It is equally necessary to see that it does not press so hard at that point as to irritate and then loosen; this is often the case.

After trimming the outer margin, turn with the pliers, the extreme edge about one thirty-second of an inch, to guard against irritation. Plates can be worn higher than many dentists imagine, judging by the way they are usually trimmed. They should be worn as high as possible, especially over the cuspids.

In fitting a partial upper plate, see that it does not infringe on the necks of the teeth, wearing, making them sore, and displacing them, and preventing the plate coming to its place on the membrane.

In fitting a full lower plate, see that it sets steady; have the patient raise the tongue to the palate, and see if it lifts the plate; then lift the lip in front and at the sides, and, if there is interference, trim accordingly.

In fitting a partial lower, see that it does not press against the teeth, and observe the rules as in the *full* lower.

Always be satisfied that your plates fit before taking further steps.

## CHAPTER IX.

### CLASPS.

THE use of the clasp is not objectionable if properly adapted, and kept clean. Often, when bridge work is used, a nicely adjusted narrow plate, properly clasped, would be less objectionable than unremovable fixtures, saving, instead of destroying, the teeth attached to.

Clasps should not be so wide as to cover a large portion of the tooth, being cumbersome, and looking badly. Neither should they be very narrow, as is the custom with English dentists, as they wear into the enamel.

As a rule, about one-eighth to three-sixteenths of an inch wide is sufficient. The material should be eighteen karat alloyed with platina, so as to be springy; in thickness about twenty-four gauge.

In selecting teeth for clasping, the second bicuspid is preferable, if the way is clear for using them, because of their straight sides, and being in a position to sustain the plate in balance. The second bicuspid is preferable; if none, then the first, especially if there is to be a small plate of few teeth. The first molar next, especially if it is a large plate.

It is not advisable, except in rare instances, to wedge or file teeth for the purpose of using clasps.

If those to be clasped to are the only teeth left of the upper set, the danger that eventually they may be lost would indicate the advisability of making a suction plate, so that the plate would still be useful; but while they remain, use clasps to steady the plate in mastication.

Fit the clasps to the plaster teeth as accurately as possible; then fit them to the natural teeth; if the clasp is on a bicuspid, do not let it pass in the front if it can pass around

the back ; in other words, avoid its showing, if possible. If it is on a molar, and can pass all around, let the ends meet at the labial surface. After fitting, spring open slightly, so as to remove easily ; with wax firmly attach it to the plate, uniting the two, and placing in the mouth, press both into place, and carefully remove. Invest the clasp and a small portion of the plate in plaster and pumice ; warm and remove the wax ; fasten the plate and investment together with a wire clamp, so that they may not become separated while heating ; if there is a space between the clasp and plate, as it is sometimes not advisable to put the clasp high up on the tooth, put a piece of gold between when soldering the clasp to the plate. Never unite them for a space of more than three-sixteenths of an inch, thus leaving full play for the elasticity of the clasp. To prevent the solder flowing beyond this point, put plaster into the joint.

Adjust but one clasp at a time, and round and thin the ends in finishing.

## CHAPTER X.

### INVESTING, BACKING, SOLDERING.

IT is well to have several sizes of sheet-iron rings, one inch deep, to invest in. Select one a little larger than the case, then there will not be superfluous plaster to heat up and keep hot; and the case is secure from accident in handling.

Mix equal parts of plaster and sand (some use asbestos, but it is more expensive, and is not so solid to back-up in). Be sure it comes in contact with the plate, for if there is a space underneath, there will be danger of melting a hole in it. When hard, warm and remove the wax, then, setting it in the sink, dash hot water on it.

I prefer backing-up in the investment, as it avoids the necessity of investing separately and heating up and soldering twice, and it can be done as well as by the other method.

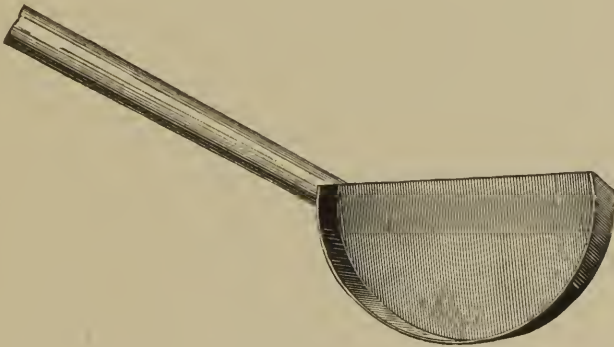
For backing, the gold should be thicker than the plate. I use *clasp* material. Cut off a strip the width of the teeth; shape the end to the plate; put coloring, ink, or other material, on the head of the pin, and press the gold on it, and punch; enlarge the surface of the opening with a small "countersink;" if it is a back tooth, cut off the gold even with the crown; if a front tooth, it looks better a little shorter, with the ends rounded and chamfered. If they are gum teeth, shape to the shoulder on the gum, and let them meet only at that point. If plain teeth, do not let them meet at all. After it is shaped, bend slightly so it will fit snugly, and with a sharp, chisel-shaped instrument split the head of the pin; it is better never to rivet, as, if only split, the solder will flow around the pin in the hole, and fasten more securely than riveting, as the solder would hold only

on top of the pin. It is well to cut off the head of the pin, if too long, before putting on the backing.

If there are spaces under the teeth, fill with foil. These should be avoided, as far as possible, by close grinding.

See that the surface of the plate is clean; mix pulverized borax on a slate or glass, having it sufficiently wet to spread easily. Cut the solder small and lay it where you wish it to flow. Place it to heat over the gas, and let it heat slowly for fifteen minutes, then turn on the full heat, and when as hot as that will make it, place in a small soldering pan (Fig. 9), and throw a full blast on the outside

FIG. 9.



SOLDERING PAN.

first, then upon the plate, heating *equally* plate and backing, till the solder flows. If the solder is what it should be, it will sweat down where it lays and blend in with the plate. To insure this, the solder should be of the same karat as the plate, eighteen to twenty. The nearer the melting point of the plate, the better the results, and the less labor in finishing.

The entire surface of the plate should be exposed. If it is a lower partial, cut out the plaster in the centre entirely, so there will be an opening to prevent the flame rebounding.

As soon as cool, place in water to soften, remove the investment, and place in the acid to boil; this cleans the

plate and removes the borax. To remove the acid from under the teeth, put the case into a solution of soda.

With the file remove all sharp corners and edges; with fine, small corundum smooth the surface over the pins and wherever the solder has not flowed properly.

Drive a pine stick into the chuck hole of the lathe, and with a sharp pocket-knife turn it to a point and finish the entire surface with pumice, following with *small-sized, soft* brush-wheels, and finally with whiting or rouge.

## CHAPTER XI.

### PREPARATION OF METALS AND MAKING SOLDERS.

IF a dental depot is easy of access, better buy than prepare plate and solder; jewelers are not usually expert in preparing them.

Gold plates of a lower karat than eighteen should never be used; I prefer twenty. It should be made with pure gold alloyed with pure copper and silver, one part of the former to two of the latter. For twenty karat, one ounce of gold and four pennyweight of the alloy; for eighteen karat, one ounce of gold and six pennyweight of the alloy.

Place in a crucible with plenty of borax, and melt, and turn into the ingot mold. Roll lengthwise to the necessary *width* of plate; then anneal, and roll to guage twenty-eight, which is a suitable thickness for all plates, except lower, which should be thicker; additional strength in special cases being obtained by doubling.

TO DISPOSE OF SCRAPS, FILINGS, AND OLD PLATES.—Save all clean scraps and portions of old plates that are free from backings, clasps, and solder, and melt. All else, including filings, through which a small horseshoe magnet has been passed to remove steel particles, should be subjected to a strong heat with saltpetre. If it does not come out tough, subject it to corrosive sublimate. If this does not do, send to an expert. This product usually has enough platina in it for clasp material, and can also be used for backings.

To make *clasp gold*, take twenty karat plate and add two pennyweights platina. Melt the gold, and rolling the platina as thin as possible, drop into the gold when melted. The gold acts as a flux, and the platina is melted.

GOLD SOLDER.—The leading dental depots provide now an admirable quality of solder. But if you wish to make it,

the following recipe, by an old expert, Dr. D. H. Goodno, makes a solder that has all the qualities desired, being remarkably tough, flows readily, and does not discolor in the mouth. He says he has rolled it as thin as a ribbon of pure gold: Forty grains pure gold, two-and-one-half grains pure silver, two-and-one-half grains pure copper, three grains pure zinc; place the zinc in gold foil and place at the bottom of the crucible; cover with borax; cut the other material fine and place in the crucible, and cover with borax; melt and roll.

Another recipe is made as follows, by first making an alloy: three pennyweights pure silver, three pennyweights pure copper, one-and-a-half pennyweights pure zinc. Roll the zinc in gold foil and place in the crucible, and cover with borax; place the copper and silver on it and cover with borax, and melt; roll thin, and use according to the karat you wish; for twenty karat, five pennyweights pure gold, one pennyweight alloy; for eighteen karat (and there is no necessity for using a lower karat in the mouth), five pennyweights gold, one-and-a-half pennyweights alloy. Always test your solder by flowing on silver plate.

SILVER.—For partial sets, when the patient cannot afford gold, silver makes a good substitute. But coin silver should never be used, as it oxidizes badly in the mouth. Pure silver, alloyed with platina, makes a good plate, which, of course, discolors from the presence of sulphuretted hydrogen in the mouth, but is easily cleaned; two pennyweights of platina to the ounce of silver is sufficient.

For clasps for silver plate use gold; and I prefer to solder with gold, using eighteen karat. *Silver solder* is made as follows: Silver, six parts; copper, three parts; zinc, two parts; melting the copper and silver, and then adding the zinc.

## CHAPTER XII.

### ATTACHMENT OF TEETH TO PLATES.

AS a rule, in partial sets, the teeth should be backed and soldered.

In *full upper sets*, it is no longer necessary to use the single gum teeth, and it is not advisable, for it is impossible, with them, to secure proper arrangement, articulation, and restoration of contour; besides, the work is not cleanly, on account of secretions getting between the teeth and plate. By using single plain teeth, and pink rubber attachments, the best results can be attained, next to continuous-gum.

For *partial lower* on gold, this method is the best, for the reasons mentioned, and also because there is such a tendency of the process to give way, in these cases, that it is necessary, from time to time, to remove the teeth and set them higher, and this, of course, is easily done, if the rubber attachment is used.

Sometimes partial uppers may be constructed in the same manner, especially when all the back teeth are replaced.

The method of attaching is to invest the case, as if it were to be a rubber plate; then solder *platina loops* at intervals on the plate; the loops may be  $\frac{1}{8}$  inch wide, one-quarter inch long, soldering the ends, or soldering the middle with the ends turned up. In an upper case put four such near the upper edge and four on the ridge.

After soldering on the loops, place the flasks together, and see that none of the teeth come in contact with the loops so as to prevent closure of flask.

Another method is to *spur* the surface with a sharp instrument; this, however, cannot always be relied on, but deep spurs in the cast metal plate are sufficient.

## CHAPTER XIII.

### RELATIVE VALUE OF THE VARIOUS MATERIALS FOR PLATES.

FOR full upper sets, continuous-gum stands pre-eminently the most perfect, in all respects, of anything ever devised, provided it is made as it ought to be, and full advantage taken of its capabilities. It most nearly resembles nature, not only in the arrangement of the teeth, but in the disposal of the gum and imitation of the palate; it is the most cleanly, and the materials are in no way objectionable in the mouth; I have found it the strongest work. More than thirty years' use has demonstrated the truth of these statements.

Next in value for *full upper* and in nearly all *partial* cases is gold. This has been used from the earliest history of artificial dentures, and has been fully tested.

Next in order for full uppers may be mentioned platina, with rubber attachments.

For *partial* uppers, some use platina; but if it is pure it is too soft for the purpose; it may, however, be alloyed with iridium.

For *partial lower*, gold is the best, with exceptional cases, when rubber (the black or the maroon) is perhaps better.

For full lower sets, where the gums show, which is rare, continuous-gum, should be used. Cast metal plates, with rubber attachments, using Watts', Weston's, or Reese's metal, make a good lower denture.

*Aluminum* is used to some extent, but is objectionable for several reasons. If the plate should crack from any cause, there is no solder suitable for the mouth, with which to repair; often there are iron spots in it, which rust through,

making holes. Recently, however, a method of casting these plates has been devised, which seems to produce excellent results, and is the method where pure aluminum is used.

Next in order is rubber, used the world over more than any other material. But, while thus used, it is open to serious objections, doing in many cases much harm to the mouth; a subject it is not necessary to discuss here.

It is not, however, an unmixed evil; it enables many people to wear artificial teeth who would otherwise be unable to afford them; then for temporary work it answers every purpose; in some cases for partial lower it is well to use it.

The last on the list, celluloid, is the least in value; having given it a thorough trial, for six years, I was compelled to abandon it. I could not recommend it to my patients longer. The objections to it are those pertaining to rubber, besides being more uncleanly, absorbing the secretions. It is difficult to repair, and is injured in appearance by the process.

There is still another material, the porcelain plate. But to make this requires long practice, and even then it is impossible to secure all the results necessary for a perfectly artistic denture. When done it is always difficult to repair, and sometimes impossible.

#### COMBINATION WORK.

There is but one kind of "combination work" that is advisable, and that is metal plates and rubber attachments.

The combination of continuous-gum on a rubber base was made quite extensively twenty-five years ago, and, as might have been expected, was abandoned. It, however, came to light again, across the Atlantic, a few years since.

The objection to it is the difficulty of repair. If a tooth is broken, the continuous gum-portion must be removed and repaired, and a new rubber plate made, involving too much expense for the replacement of a tooth. The same objection holds good in continuous-gum and cast metal plates.

The combination of rubber and celluloid is a difficult kind of work to make, for which a good price should be charged, and then the price charged would have paid for a metal plate, which would have been far preferable.

The combination of celluloid and gold is objectionable, for the reasons that apply to the celluloid alone, and also that the celluloid does not adhere to the plate, and in case of repair is just about ruined.

## CHAPTER XIV.

### CONTINUOUS-GUM.

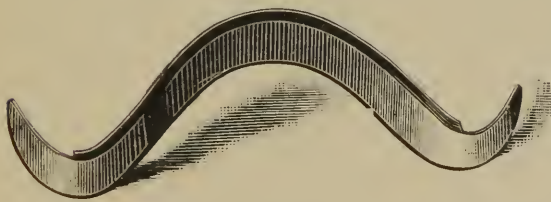
THIS is the most difficult to make, and yet the most perfect when completed. It has stood the test of time, and remains to-day unparalleled as an artificial denture. I do not see how there can be anything superior to it, at least in its adaptation where a porcelain gum is an absolute necessity, and must be very high and very thin, with no seams.

There cannot be too much care bestowed on its construction, and it amply repays the careful operator who avails himself of all its possibilities; with this work the shape of the teeth can be modified by grinding, or building on to, and when it is finished, the enamel, where ground, has again fused.

The plate should be swaged the same as for gold, using the best French plate, gauge twenty-eight. After fitting, and articulating bite secured, place in the articulator and remove the wax.

With lead make a pattern about  $\frac{1}{4}$  inch wide, covering the entire posterior of the plate, and around the corners. This is for a "doubler," (Fig. 10,) and should be gauge thirty.

FIG. 10.



DOUBLER.

First swaging in the dies, then fit with a broad flat burnisher, and turn up the inner edge slightly to the

top of the tuberosity; clamp with two clamps across the center, after putting in a little borax; solder (always using

pure gold, as alloyed gold would discolor the gum in baking) for about  $\frac{1}{2}$  inch; removing the clamps, replace on the model, and burnish again closely, and clamping, solder still farther, and so continue, by degrees, until finished.

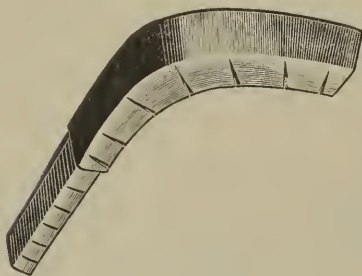
Take round wire, gauge eighteen and *roll* to gauge twenty-one. File one edge flat, and beginning where the inner edge of the "doubler" is turned up, at top of tuberosity, fit the wire with pliers for the distance of  $1\frac{1}{2}$  inches, clamp and solder only  $\frac{1}{4}$  inch; then place on the model, and fit *closely*, a short distance each way, and solder again, always clamping tight, and so on till it is all attached.

The teeth being arranged, insert, in equal parts, plaster and asbestos, leaving it about  $\frac{1}{2}$  inch thick underneath and all around.

When hard, warm slightly and remove the wax, finally dashing boiling water into it, so as to thoroughly cleanse of wax.

Turning up the pins, make three patterns, one each covering the molars, bicuspid, and cuspids, and one piece covering the six front teeth, with a foot-piece three-sixteenths of an inch wide, resting on the plate. Make the backings

FIG. 11.



BACKINGS.

(Fig. 11), same thickness of the plate; cut the edges for foot-pieces in slits, the width of foot-piece, and turn at right-angles, and with an instrument (I use a worn-out scraper) press into place, under the pins. The front-piece, of course, will lap over the side pieces, *on the cuspids*.

Have the pure gold rolled very thin, cut in small pieces, and lay underneath the foot-piece, and a piece under each pin as it is turned down, pressing the backing snugly to the plate; *use no borax*.

I prefer soldering in the furnace, the first thing after the fire is made. It can be done, however, with a bellows blow-pipe.

After cooling, remove the investment, wash thoroughly, and there is no need of boiling in acid. Place on the model, and press into place; see by the articulator if the position of any of the teeth has been changed, and if so, correct.

The only instrument needed for applying the body is a wax-knife, straight and pointed at one end, and slightly curved and pointed at the other. (Fig. 12.)

In addition to this there is required a quill tooth-pick, camel's hair-brush, a stiff dry brush, a set of boxes, setting one into the other (used by artists), a spatula, a small cloth for absorbing, and a small glass of water.

The materials, body and gum, are ready prepared, and sold at the dental depots. I have always used that made by S. L. Close, New York.

Apply the body, which has been moistened so as to be quite thin, with the flat end of the instrument to the outside; beginning at one end, work it thoroughly under and around the teeth, by jarring; then absorbing with the cloth, apply more, after having thickened it somewhat; continue this process of jarring and absorbing, then packing hard; when built up sufficiently, dry partially over the gas or lamp, contouring the gums and trimming around the necks of the teeth. Then apply to the palatal surface in the same manner with the curved end of the instrument, but thin; brush all particles from the teeth or plate; place on a slide and run into the furnace gradually on a sheet-iron shelf attached to the furnace, occupying perhaps half an



Fig. 12. WAX KNIFE.

hour, the heat meantime coming up, so that when the case is in the furnace and the muffle closed, there is a baking heat. The proper amount of heat must be judged by the appearance of the body, it having a glossy look; place in a cooling muffle and close, remaining till cool. Care, of course, must be taken not to *over-bake*. The baking is not easily learned, except through personal instruction, and must be closely watched.

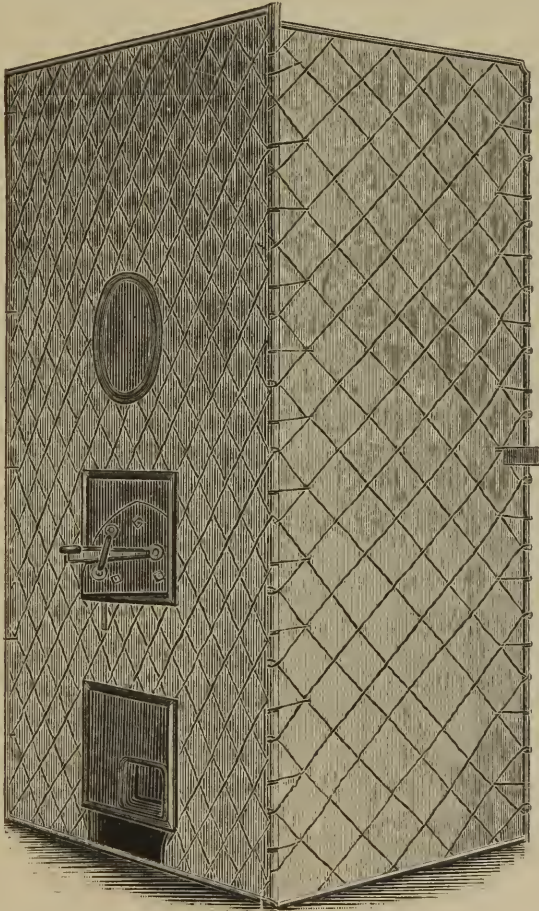
It will be found that the body has shrunk, and left crevices, which must be filled up thoroughly, and the surface built up to the proper contour again, and at this stage the *rugæ* may be formed. The case is again run into the muffle slowly, as before, and baked. After cooling, the gum enamel is applied. This is done with the same instrument as the body, but care is required to put on a uniform coat, with proper shadings; and unless properly done, it is liable to curl up from the body. It is baked the same as the body, and with the same test.

After cooling, file the binding even with the enamel, rounding the edge of plate and binding; file the "doubler" wherever it can be reached, and use a small, fine corundum where the file does not reach. Finish with pumice and pine stick and polishing brushes. In making a lower set, do not put on a wire, nor turn the edge, but *double* the edge  $\frac{1}{8}$  inch wide all around, and let the material extend to the edge.

*Repairing* is easily done, with a little experience. First invest the entire case  $\frac{1}{2}$  inch thick in asbestos and plaster, and place in the back of the muffle before lighting the fire, allowing the heat to come up slowly, and the case to remain till red; cool, and remove investment. Grind out the remains of tooth or teeth to be replaced, as also some of the gum, outside and inside; select the teeth (rubber teeth will do), and fit them to their places. If there is but one in a place, it can be held there with the body (which should be of a lower fusing quality), applied carefully and dried. If there are several teeth, arrange with a little wax, and then over the ends, and also on one or two adjoining teeth, place

a thin coating of plaster and asbestos; remove the wax and pack the body around, quite thin at first, and run the case into the muffle somewhat more slowly than a new case. It will not require as much heat. After cooling, place enamel where needed, and bake.

FIG. 13.



CONTINUOUS-GUM FURNACE.

Sometimes the grinding surfaces of the molars and bicuspid appear rough after baking; it is from the presence of lime, coming from the secretions of the mouth. Put a slight coating of borax upon them before the second baking.

If "blisters" appear, grind into them, and fill with repairing body, and enamel over it.

For *furnace*, both the coke, and gas and "hydro-carbon" are being used. I prefer and use the coke furnace. I like a large-sized muffle; it is more convenient to work in. I am using the Boulter furnace, No. 2, made in Philadelphia. Have a table made three feet square, two feet high, and covered with two layers of brick, enclosed, over which place galvanized iron.

If you wish to shut the heat out of the room, have a wire frame made, over sides and top, and setting against the chimney, with a removable front, and holes corresponding with the furnace openings, and cover with asbestos felt. (Fig. 13.)

Make a socket in the front of the table, in which to support a removable upright, on which to rest a shelf, to place the slide on while running it into the muffle.

Leave space around the furnace-pipe, where it enters the chimney, for heat from the outside of the furnace to pass off.

The muffle should be luted with fire-clay only at the front, leaving the rear free, as there will be less danger of its cracking across the middle from shrinkage in a high heat.

The clinkers should, from time to time, be removed from the sides of the furnace with a cold-chisel, striking sudden blows, so as not to injure the lining.

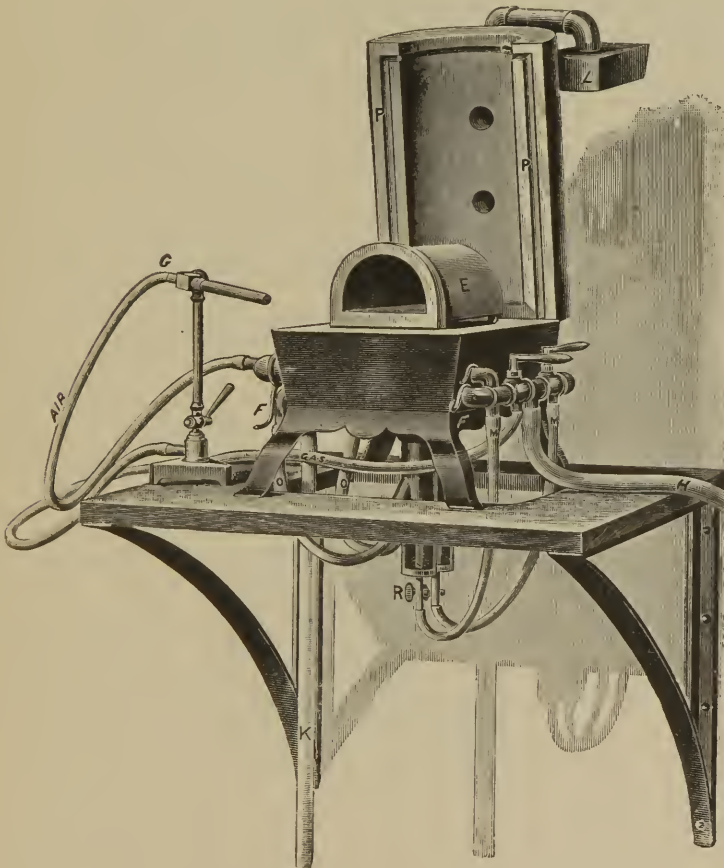
Tees' Lilliput Furnace I have used often in demonstrating. It works nicely; my principal objection to it is that the muffles are small and thin.

There is a hydro-carbon furnace, made by Hoskins, Chicago, which some use; the heating arrangement may also be used for a melting furnace, for refining gold, etc.

The Verrier Gas Furnace is very objectionable for two reasons—its constant liability to “gas” the work, and the lilliputian dimensions of the muffle; some sets could not be put into it.

One of the best gas furnaces is Dr. C. H. Land’s, (Fig. 14), of Detroit. He claims there is no liability to “gasing” in its use. (Send for illustration and full descriptive circulars

FIG. 14.



DR. LAND'S GAS OR GASOLINE FURNACE.

to Dr. Land, or to The Wilmington Dental Manufacturing Company, Philadelphia.)

Since the first edition of this work was published a very simple and excellent gas furnace has been placed on the market, by Drs. Parker & Stodard, of Boston. Instead, however, of the bellows which they use, Dr. Berry, of Milwaukee, makes use of a cylinder of compressed air.

Any one intending to undertake the construction of continuous-gum work had better take instructions of some competent dentist who has had experience in the work, as there are many little details which can only be learned in this way.

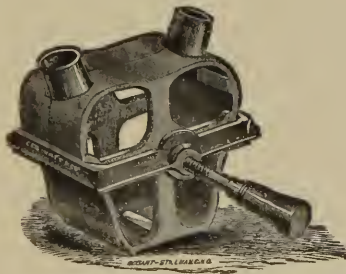
## CHAPTER XV.

### CAST METAL PLATES.

FOR full lower plates these are extensively used, first, because of the *weight*, which is a valuable adjunct of lower sets. Then we have *metal* in contact with the membrane, which is an advantage over rubber, and being a non-shrinking metal (tin and bismuth), cast on a non-shrinking model (plaster and pumice, or sand), furnishes a more perfect fit than by swaging, and as alteration of the margins of lower plates is often necessary, we are able to do it without injuring the appearance of the work.

The process is as follows: Fill the impression with plaster and pumice, or marble dust, equal parts; remove the impression with care, as it is not as strong as pure plaster; form a wax plate, and double the edge  $\frac{1}{8}$  inch wide, which will have the appearance, when finished, of a "rim;" invest the model in Watts' (Fig. 15) or Weston's flasks, using equal

FIG. 15.



WATTS' FLASK.

parts plaster and pumice, or marble dust; when hard, warm slightly and remove the wax. Cut gates in the plaster, about  $\frac{3}{16}$  inch diameter, from the extreme point of each heel,

opening into the flask gates; apply heat gradually till *all moisture* has disappeared, evidence of which can be had by holding a hand-mirror over the plaster. Then close the flasks, apply the clamp, and pour the metal from an iron spoon. Have a wet cloth at hand, so if there should be a leakage, apply it quickly. When cool, finish with coarse file and sand-paper. Spur the surface with a graver quite deeply. Arrange the teeth as in a rubber set, and attach with pink rubber.

## CHAPTER XVI.

### VULCANIZED RUBBER.

ARRANGE on the plaster cast a wax plate,—or wax and gutta-percha plate is preferable; arrange a rim of wax on it, and get a “bite,” to show the impression of the lower teeth and relative position of the jaws.

If a full upper and lower, arrange the lower wax and trim by the mouth to the right length; then place the upper and obtain a closure, and while in position make several lines in the wax; remove and trim and replace to see if the closure is the same each time. It is not necessary to attempt to secure the proper fullness and length in the wax; this will have to be done when arranging the teeth, with the patient in the chair, whether full or partial cases, as it is only by the mouth that the proper arrangement and expression can be secured.

Place the cast and “bite” in an articulator, to retain the relative position of the jaws, and aid in arranging the teeth.

After arranging the teeth, form the wax for the gum, so as to restore contour of features, trying in the mouth till patient and dentist are satisfied with the result.

Invest in the flasks. If it is a full case, invest to the margin of the wax; smooth the surface, shellac, and oil; place the other half of flask in place, and before turning in the plaster, spread some of it with a knife over the surfaces of the teeth, so as to be sure it will fill all spaces between, then turn in a portion of the remainder, and jar, so as to be rid of air-bubbles. To remove the wax, place in pan of cold water over the gas, and as soon as it *begins* to boil remove and separate, and it will be found, usually, that the wax can be easily removed. Then, to clean thoroughly, dash hot water

upon it; cut narrow gates one-half inch apart all around, and *scrape the entire surface slightly* to insure closure of flasks.

To pack, place the pieces of rubber on a plate of tin or zinc placed over a pan of hot water. If you would be specially accurate of the amount of rubber, measure as follows: Have a glass test-tube, or some similar utensil; save the wax, roll it up and put it in the tube, filling with water carefully; remove the wax and in its place put the rubber, till the water is at the top again, and then add a little for excess.

Observe, when waxing up, whether one side requires more material than another, and bear this in mind in packing. Pack small pieces behind the teeth, and then use strips, and one piece sufficient in size to cover the palate.

For rubber, the red, colored with bisulphide of mercury, is objectionable; serious results have sometimes followed its use. The black and the maroon are free from deleterious substances. For the surface of the gums use the pink. The color of this is improved by bleaching with alcohol in a glass jar exposed to the sun for half an hour or more.

The palatal surface should be covered with tin foil; cut a piece the proper size, and with a cloth, or tissue paper, rub it to the cast, and it will adhere sufficiently. Then slightly coat with soap, to prevent its adhering to the rubber when vulcanized.

Put the flasks together, and place in the press, immersing both in the hot water; bring gradually together. If you have any doubts of a lack of rubber, open and examine (having placed a piece of cloth over the rubber so it will not adhere to the foil in opening), for though there may be enough it may be unequally distributed.

Instead of using the bolts to hold the flask, the "spring-clamp" is preferable.

As to vulcanizers, you can take your choice. Some are more easily adjusted and handled than others. A vulcanizer arranged with a steam gauge is more reliable than one with thermometer attached. The Gartrell Gas Regulator and

Steam Gauge, furnished by The Wilmington Dental Manufacturing Company, I like very much.

If the rubber is very *thick*, the heat should be applied more slowly than with thin rubber, to avoid its becoming porous. The black rubber requires lower temperature and longer time. In fact, in this way all rubber is stronger, so that instead of vulcanizing at three hundred and twenty degrees for forty-five or fifty-five minutes, two hundred and eighty degrees to three hundred degrees for two hours produces tougher rubber.

On opening the flasks, try the rubber by breaking off a gate, to see if it is hard enough.

With coarse file, shape the margins and surface of gums; then use the large bur for the lingual surface, using the calipers to avoid making it too thin, yet give the patient all the space possible for the tongue, without sacrificing strength. Also, by use of the large bur festoon around necks of the teeth. With thin, sharp chisel, trim around the necks of the teeth, and, with small sharp points, between. Use the *round* scraper for the palatal surface. Sandpaper (No. 0 or 00) thoroughly, and finish with pumice, either with a pine stick in the hand, felt cone, or both, and finally with *small, soft* brush wheels.

A partial case, where there is no rubber outside the gums, should be invested in the deep part of the flask, covering the teeth entirely.

## CHAPTER XVII.

### CELLULOID.

THE process for celluloid is similar to that for rubber, but requiring a different flask. Instead of packing a soft material in the molds, to be hardened, a hard material is placed between, to be softened and pressed into place.

The celluloid is prepared in blanks, of various sizes and shapes. When the case is ready for the blank, it is placed between, sometimes altering by filing, or heating in boiling water and bending, so as to bring into better shape for the flasks.

There are two methods of applying heat, dry and steam. There are various appliances for this purpose. The latest and most perfect is the New Mode Heater, where, though steam is used, the case is in a dry air chamber.

Finish the same as rubber. It should never be allowed to remain out of the mouth without being placed in water, as it has a tendency to warp.

The cheaper heaters for this work are not desirable, and have long since been abandoned by most of those who have used them.

I have given celluloid six years thorough trial, and am convinced it is the worst material used in the mouth.

## CHAPTER XVIII.

### REPAIRING.

#### GOLD OR SILVER.

REMOVE the remains of the broken tooth and the backing. Select a tooth and wax into place; insert in plaster and sand, or marble dust, and put on the backing.

These repair cases should be heated slowly, taking an hour for the purpose, then solder. Cool off slowly, and it will be a rare occurrence that a tooth is cracked.

If the plate has cracked and *spread*, let it remain in that condition, as it has followed a change in the gums. Lay a piece of wet tissue paper over the crack on the under side, so the plaster will not get into the crack. Scrape the surface of the plate; invest and fit a small piece of plate over the crack; lay the solder in small pieces along the sides; heat and solder. If your solder is right and you give it proper heat, it will not only flow under the piece of plate, but also into the crack.

To solder a gold plate in repairing, where there are rubber attachments, take a turnip or potato and enclose in it the rubber portions, and proceed to solder the tooth, clasp, or crack.

#### RUBBER.

Remove the broken tooth, and file away the rubber back of it; select a tooth that will go into the impression of the neck of the former tooth, and wax into place; insert in the deep half of the flask; remove the wax, scrape the surface of the rubber, and, with a hot spatula, spread rubber on the surface. Then pack the balance, and complete the investment and vulcanize.

If the plate is cracked, cut away the length of the break, from each side,  $\frac{1}{4}$  inch, and nearly the thickness of the plate at the break. If the break has extended to the outer edge, under the teeth, remove one of the teeth, cut away a portion of the break, wax the tooth into place, and wax over the break, invest, and wash out all the wax, and, if necessary, remove the tooth, and pack the rubber back of it, then replace and pack elsewhere, and vulcanize.

In repairing a partial lower, carefully place the fractured ends together and wax into place; insert and cut away the rubber for a space of  $\frac{1}{4}$  inch each side of the fracture, and at the fracture to its full depth; pack as before described.

#### CELLULOID.

Prepare as in rubber, and, after removing the wax, scrape the surface, apply camphor, and place a piece of celluloid, wet with the camphor, where needed, and put into the press; apply a strong heat, and press into place.

## CHAPTER XIX.

### SELECTION AND ARRANGEMENT OF TEETH.

IN no department of dental practice is more skill, judgment, and experience needed than in this; and in none is there so little manifest, if we judge from the average artificial dentures in wear, especially full sets.

Dr. W. W. Allport, of Chicago, well expressed it in an address before the Boston Academy of Dental Science:

“He who has but moderate ideas of symmetry, harmony of expression, and color, is constantly pained by the lack of that artistic selection and arrangement of artificial teeth which serve to restore to the face the shape and expression left on it by the Creator, the absence of which in artificial dentures stamps him, who should be an artist, an *artisan*, as a mere mechanic—a *libeler of the soul*—a *deformer of the human face divine*. That mechanical dentistry should have very largely fallen into the hands of this inferior class of practitioners, will hardly be wondered at by those who have watched the history of this branch of the practice. For so simple are the modes of attaining tolerable mechanical results, with the methods now usually employed in this department, by the use of rubber plates and ‘gum sections,’ that one possessing a high order of appropriate talent is seldom found devoting much time to it.”

It is difficult to give oral or written instruction on this subject; it requires the clinic, often repeated. As the dentist is constantly at work upon the natural teeth, he should study the subject from that standpoint.

The indiscriminate use of “gum sections” is largely responsible for many failures, for it is impossible to secure proper results, in all respects, where they are used. Their appearance is sometimes an outrage on the human face.

I long ago ceased to use them, using instead, plain teeth and pink rubber gums. The question is asked by dentists: "Suppose your patient says she wants a more natural-looking gum?" I tell her it is better to sacrifice somewhat on the *color* of the gum than so much in other respects, by the use of gum teeth. I never yet have had to change the teeth in such cases.

I arrange the teeth and a wax gum, and tell the patient that the wax will be replaced with a gum, but do not say what kind, and they seldom speak of it afterwards.

If there is prominence of the upper jaw and short lip, the worst class of cases to deal with, the gum teeth are utterly out of place, because while a *porcelain* gum is a necessity, it must be very *thin*, *high*, and *seamless*. In these, the continuous-gum process is the only available one, as by it a thin gum can be secured and yet be strong, because it is baked to the plate.

In selecting teeth, if there are teeth remaining in the jaw, there is little difficulty, because it is only necessary to match, in shape and color, these natural teeth.

Do not use gum teeth unless it is absolutely necessary. If it is, look for teeth with the gums extending but a short distance below the neck of the tooth, as the natural gum has receded and needs to be matched in this respect. The corners of the gum on a single tooth should be rounded and ground, to match nicely the natural gum. Generally there is not room for the plate behind the gum, without making the gum too thin, or preventing the setting of the gum far enough in to match the natural gum. The gum as well as the teeth should match in shade.

As far as possible, select front teeth with the pins *perpendicular*; occasionally the bicuspid and molars require "cross" pins.

In *partial rubber* sets, the rubber can often be used for gums, and when possible, it is better.

If the bite is so close in front, there is not room for the

thick rubber teeth, select a plate tooth, and solder a backing, with a foot-piece that can be enclosed in the rubber.

If the bite is very close over the lower posterior teeth, make use of cuspids, or else what are known as "crown" teeth, instead of bicuspid and molars, and have the lower teeth close on a rubber surface.

In case of a gold plate, when this condition of things exists, attach the teeth with rubber, or make a shoulder of gold to bite on.

In the selection of teeth for full upper sets, the lower are usually a guide in color and size. I say in size, in this way: the upper teeth, when properly articulated, should be so arranged that the cusp of the lower cuspid is between the upper lateral and cuspid; so that upper teeth which do this, it may safely be assumed, are the size of the natural ones. This allows of the interlocking of the bicuspid, as nature arranges for. If, in the preparation of the mouth, there should be extracted a central incisor, be sure to retain it as a guide in the selection of artificial teeth. The patient will sometimes insist that you have selected teeth larger than the natural. I have often in this way shown patients that I have selected teeth no larger, and sometimes a trifle narrow, when they have supposed their new teeth were larger.

There is a great tendency to use *small* and *white* teeth, which often give an insignificant expression to the mouth, the patient looking as though wearing their deciduous teeth. I sometimes remind them that it is time they had shed their "baby" teeth.

The dentist must be guided by the general appearance of the natural teeth. The study of physiognomy and temperament is of great value in deciding what to do when *all* the natural teeth are missing. As a guide, I have prepared the following table, abbreviated from the elaborate one of Dr. J. Foster Flagg's, which will be found serviceable. Of course, there are variations from these, as there are combinations of temperament.

	BILIOUS.	SANGUINEOUS.	NERVOUS.	LYMPHATIC.
	Tall, angular, Square-built.	Full, firmly Rounded, Robust.	Delicate, Slightly built.	Bulky, clumsy.
CRANIAL CONTOUR...	Angular, high cheek bones.	Rounded and Full.	Oval.	Flat-faced.
HAIR... ..	Black and curling.	Golden to light chestnut.	Brown, wavy, fine.	Coarse, straight, drab.
EYES... ..	Black.	Blue.	Dark brown.	Gray.
LIPS... ..	Large, Brownish, Purple.	Ruddy and full.	Fine, grayish pink.	Large, not shapely.
TEETH, SHAPE... ..	Large, longer than wide, Angular.	Well propor- tioned, curved and rounded.	Long, almond-shaped.	Large, width predomi- nating.
TEETH, COLOR... ..	Brownish, Yellow, Opaque.	Straw, yellow, translucent.	Pearl-blue, translucent.	Dark gray, opaque.

All teeth are variably yellow at the neck (some very slightly). They become darker from the cuspids to the posterior. The cuspids are always more yellow than the incisors, and the bicuspid and molars darker still.

This rule, however, is not followed by the manufacturers, but the dentist, in matching partial sets, at least, should see that the *posterior* teeth are the *darker*. Usually, there is more yellow in the lower than in the upper teeth.

It is not, however, always possible to secure just the shade required from the stock to which you have access; neither is it the case in the large stocks. This is partly because so many dentists are indifferent, or do not know what is proper. If dentists had more cultivated tastes and were more particular, so as to make an imperative demand for better shaded and shaped teeth, they would speedily be made.

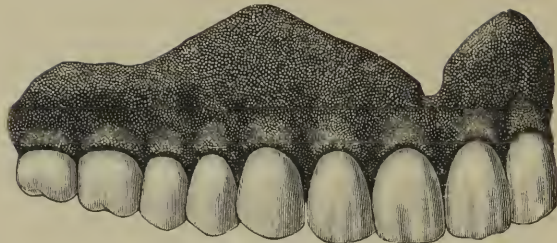
There are certain general directions that may be given for the *arrangement* of the teeth.

Be careful not to make the teeth *too short*. This is a very common failure, patients often appearing as though they had no teeth. Remember that when the teeth have been extracted many years, and too short teeth have been worn, the lips contract, consequently make the teeth longer than you otherwise would, as the muscles will lengthen again.

Always arrange the upper teeth first, in *full* sets, as they give the character to the face. Arrange the *ten* anterior teeth, so that if placed upon a flat surface they will rest evenly; arrange the molars shorter and on an oblique line. The lower teeth arranged to these, will show, upon a flat surface, only the incisors and second molars touching. This arrangement, is, of course, nature's, and will effectually prevent the lower denture sliding forward, as is sometimes the case.

In all cases where the cuspids have been missing for a year there is absolute necessity for the plate to be higher, (Fig. 16) and the gum fuller, than elsewhere, so as to restore the contour of the lips.

FIG. 16.



TRIMMING THE PLATE.

If the upper lip is short, the natural teeth show much more than when it is long. Some persons can scarcely cover the natural teeth; they show the whole length of teeth and much of the gum. If the upper lip is very long, the natural teeth do not show at all.

The lower teeth do not generally show as much as the upper; seldom are the gums seen.

Rarely allow a *drawn-in* appearance to the upper teeth. It sometimes occurs in the natural organs, but is usually a deformity, like some other irregularities, not to be followed. The teeth, as a rule, should stand perpendicular, avoiding either an inward or an outward slant. Of the six front teeth, the cuspids should generally be the most prominent, especially at the neck. The bicuspid should drop inside a trifle of the range of the cuspids, and from there back be nearly on a straight line.

There are various irregularities of the natural teeth; such as over or under-lapping of the laterals and centrals. If it is a pointed jaw, and the lower front teeth are contracted, the centrals should be the most prominent, and the laterals *dropping back* a little, and the cuspids still more.

If the arch is broad, the laterals should overlap, if not in a line with the centrals. We should set the teeth apart in some mouths where there is plenty of room, and close or even lapping when there is a small arch, and in some mouths make the teeth quite irregular, if it is a person of large build, especially if his lower teeth are crowded and irregular.

Never consider it necessary to make the teeth absolutely ugly to look natural.

For a lady of regular features, irregularities, except slight ones, are to be avoided. Nothing more than the setting apart, or slight tipping of a lateral, is needed.

Where both sets are being inserted, they should always be arranged together.

In the arrangement of the lower teeth, after the length is decided on, the width of the six anterior teeth should be such as to bring them within the proper compass for a correct articulation; that is, so the *point* of the *lower cuspid* comes between the upper lateral and cuspid. Then there is no difficulty in securing a correct apposition of the bicuspid and molars. To do this, it is usually necessary to crowd the lower teeth, unless the uppers are large. The over-lapping and irregularity of the lower teeth are generally in the line of nature, and always give a natural appearance.

Of all places, gum sections are most out of place on the lower jaw. The necessity of setting the teeth sufficiently in over the ridge makes it generally impossible to get them there without grinding away the gum too much; with them it is next to impossible to give the proper arrangement of the teeth, so as to secure a correct expression and articulation. If gum sections are used on the upper jaw, they should at least be discarded on the lower.

The utmost stress must be laid on the correct closure of the teeth. *There are more failures arising from this cause than from misfits.* The jaws should close so as not to disturb the position of the plates, otherwise there is trouble. It should be borne in mind that whenever the patient swallows, as they are constantly doing, without thought of it, the jaws close tightly, and this, of course, displaces the plates if the teeth are not properly articulated.

A common fault is the interference of the anterior teeth. When they strike before the posterior teeth do, the upper plate is crowded forward and down from the rear.

The six anterior should never meet, except where mentioned later. When, as is usually the case, the upper close outside the lower, they should drop not more than  $\frac{1}{8}$  inch below the ends of the lower, and there should be at least  $\frac{1}{8}$  inch space horizontal between them, and even then, in time, by the settling of the gums, they will come together, and need grinding to prevent strong pressure.

If it is a protruding lower jaw, let the upper teeth be arranged over the ends, but not meeting; the back teeth being long enough to take the pressure off the front teeth. In excessive prominence of the lower teeth, arrange the ends of the upper teeth inside of the lower, as nature had done; then if they do meet slightly, the pressure will be favorable to the upper.

The posterior upper teeth should never be allowed to drop on an inclined plane from the cuspid to the molar. The expression is bad, and the possible advantage claimed by some in use is not sufficient compensation.

The manner in which the *surfaces* of the bicuspid meet is of importance. The *posterior side* or slope of the lower bicuspid should press on the *anterior* side of the upper. The lower anterior teeth should be set well in over the ridge, otherwise there is undue prominence of the lower lip.

The pressure should fall mainly on the bicuspid and first molars, not allowing the second molars to meet, because when there shall be a closer approximation of the jaws by the settling of the gums, these teeth will feel the pressure excessively, and there will be irritation of the membrane and crowding forward of the plates; this will be felt specially on the *lower* jaw, and require the shortening of these molars.

If there are wisdom teeth standing alone on the lower jaw, they are usually inclined forward, so the surface is often at an angle of  $45^{\circ}$ . They should be avoided in arranging the upper teeth, for if they meet it will result in crowding the plate forward, and the difficulty will constantly increase.

A difficult condition of things is met when a full upper set is inserted, and there remains on the lower jaw the six anterior teeth, and on one side one, or, perhaps two bicuspid, and nothing on the other. Here there is nothing to counter-balance the pressure on these bicuspid. The insertion of partial lower would be of no value, for they would soon yield to pressure; but, if these bicuspid were extracted, and on both sides were artificial teeth, the difficulty would be removed; the patient would have a good masticating surface, and no displacement of the plate. In such instances the best interests of the patient should be consulted, and not mere sentiment about extracting sound teeth.

If *all* the teeth remain on one side and none on the other, make a virtue of necessity, as there is so much involved in the sacrifice. Build a biting surface for the lower cuspid; if it is a rubber plate, insert a small piece of a tooth, with the pins in it, in the rubber back of the upper cuspid.

The articulation of teeth is sometimes very difficult. Great care must be exercised that there is no one tooth nor one side meeting before the other.

When the lower anterior teeth are much longer than the bicuspid, shortening of them is always desirable, or sometimes building up these bicuspid or placing crowns on them is essential. If this is not done, make the upper bicuspid sufficiently long to throw the jaws apart, so that the upper will not close too far below the ends of the lower. If the surfaces of the bicuspid are *inclined planes*, grind, if possible, so as to make a square biting surface.

The general position of the lower posterior teeth should be such that the force of the pressure is toward the center of the upper ridge, and not outward. It is usually more difficult to properly arrange the lower set than the upper.

The two sets should always be arranged together, then finish one and try in, and correct any faults arising from the two sets in wax arranged at once.

In ninety-five per cent. of mouths, there is more depres-

sion at the *left* side in the region of the cuspids than at the right, so that the teeth need to be extended lower from the plate, to secure a proper range with the lips; and also more thickening of the artificial gum, to restore the contour of the lip.

A valuable article upon "Typical Tooth Forms," by Dr. E. T. Starr, appeared in the *Cosmos* for August, 1889, from which we quote the following suggestive paragraphs. They will be found a great aid in arranging teeth, and we advise their careful study.

"Some years since, Dr. W. G. A. Bonwill read a paper before the Odontological Society of Pennsylvania, in which he made the following claims:

"That the lower human jaw forms an equilateral triangle, the base of which is the distance from center to center of the condyles, and the sides the distance from these points to the median line of the inferior incisors, the average measurement of the sides of the triangle being about four inches.

"That in ninety-five per cent. of cases the superior jaw projects beyond the inferior, the depth of the underbite varying from three-eighths to one-sixteenth of an inch, and that in not more than five per cent. of articulations do the incisors come directly together.

"That the ramus has a definite curvature, and that the depth of the underbite and the length of the cusps of the bicuspids and molars correspond therewith.

"That the teeth in the arch posterior to the cuspids are almost directly in a straight line toward the center of the condyles.

"The substantial correctness of these conclusions appears probable.

"Plate III, which is a perspective view of the occluding surfaces of the set of natural teeth illustrated in Plates I and II, shows the equilateral triangular basis of the inferior jaw. A-B shows the width of the base or hinge of the jaw; A-C and B-C show the length of the line from the condyloid process to the center of the curve of the inferior incisors.

The Superior and Inferior Jaws  
in Occlusion.

PLATE I.\*

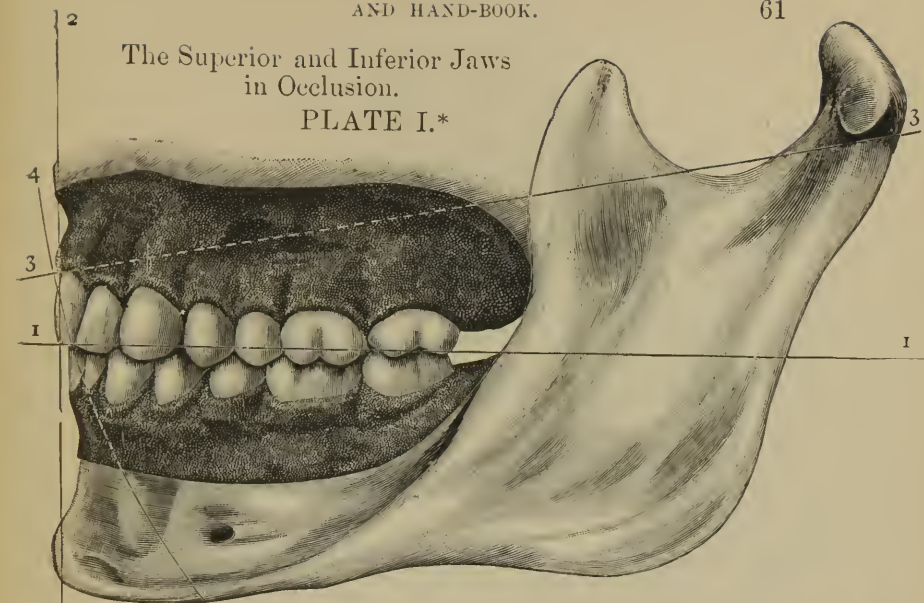
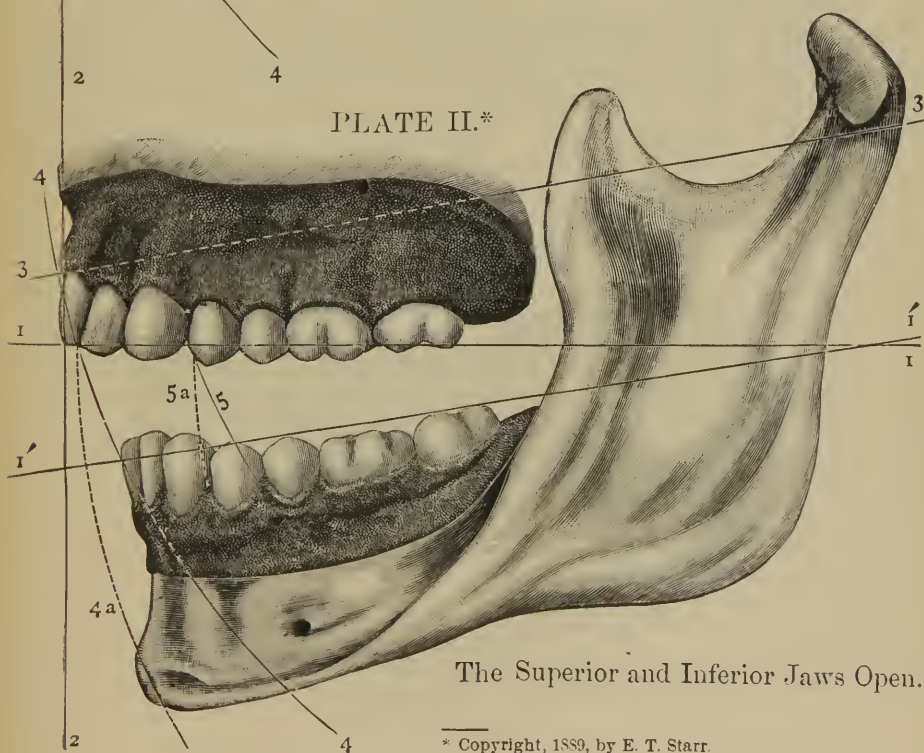


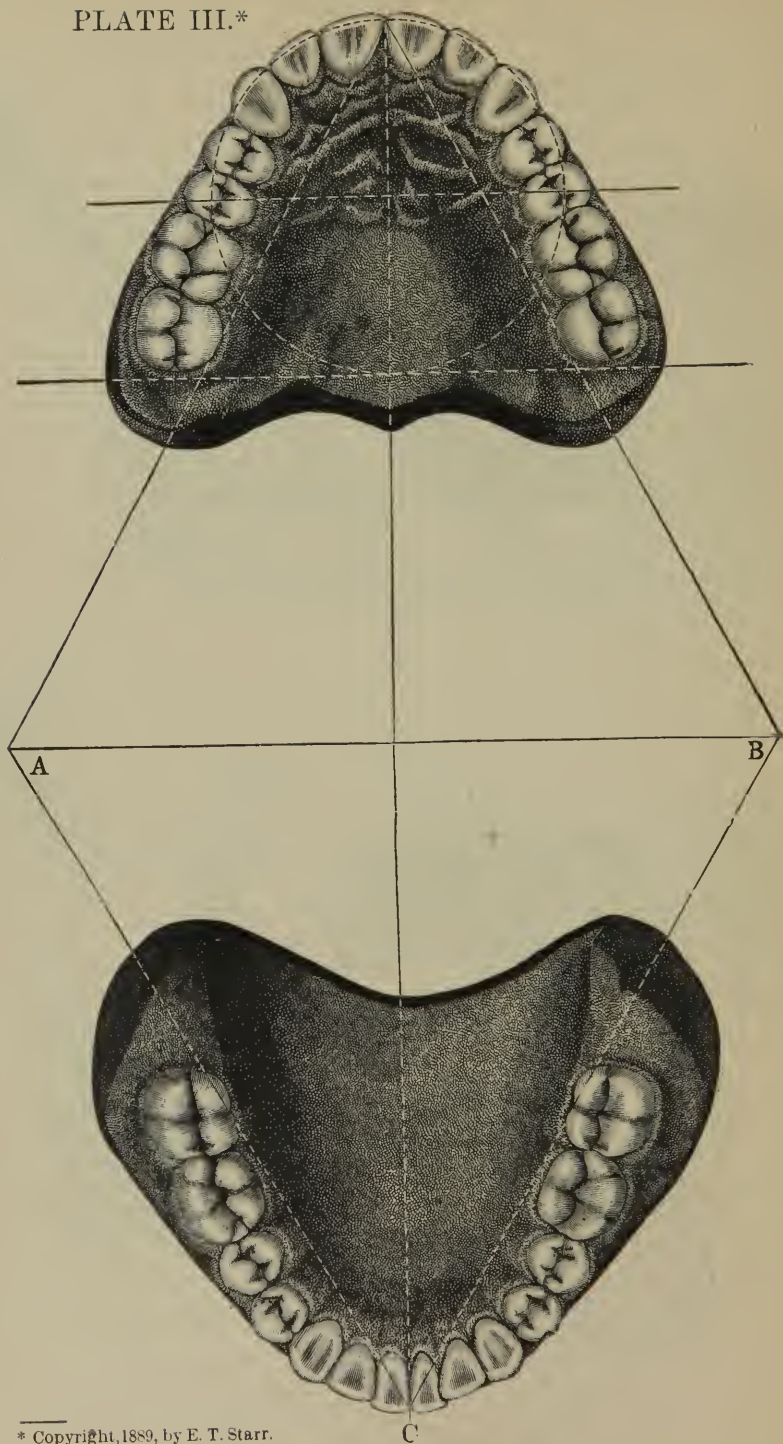
PLATE II.\*



The Superior and Inferior Jaws Open.

\* Copyright, 1889, by E. T. Starr.

## PLATE III.\*



\* Copyright, 1889, by E. T. Starr.

“The centers of the tips of the anterior superior teeth are in the arc of a circle, the center of which is found by measuring from between the centrals along the median line of the mouth a distance equal to the combined widths of the superior central, lateral, and cuspid, taken at the lines of greatest breadth. A line, at right angles to the median line of the head, through the center of this circle, which is known as the circle of the mouth, will pass through the centers of the second bicuspid; and a similar line, parallel to the first, through the posterior periphery of the circle, will pass through the posterior edges of the second molars.

“The cuspid and the anterior buccal cusp of the first molar, it will be remembered, have been previously spoken of as forming respectively the primary and secondary springs of the superior arch; that is, they mark decided changes in its direction. In Plate III the superior central, lateral, and cuspid, as has been said, lie in the arc of the circle of the mouth. At the cuspid the direction changes; the buccal faces of the teeth between the cuspid and the anterior buccal cusp of the first molar lie in a straight line. At this latter point, which is usually prominent, the arch is again deflected slightly inward.

“In the inferior jaw there is no secondary spring of the arch. The four incisors are more nearly in a straight line than their corresponding teeth in the superior jaw. The direction changes sharply at the cuspid, and thence forms a continuous, gentle curve along the buccal faces of the teeth, though the lingual faces of the posterior teeth approach very closely to a straight line. (These latter points do not appear in Plate III, as the teeth were drawn in position to give a perspective instead of an exact face-view.)”

In order to make practical these suggestions have different sizes of tin circles, and select, by use of dividers, one whose *radius* is the width of the central, lateral and cuspid teeth of the set you have selected for the case in hand.

## CHAPTER XX.

### TEMPORARY WORK.

PATIENTS dislike to go very long without teeth, and it is unnecessary. Long experience has satisfied me, that, as a rule, the teeth should be inserted within forty-eight hours after extraction, taking the impression as soon as the bleeding has stopped, and before the gums have swollen.

When the front teeth or their remains have just been removed, I make use of the sockets to insert, for a short distance, the necks of the artificial teeth, giving, of course, a natural appearance to them.

There is rarely room for an artificial gum in temporary cases, and then only that furnished by the rubber plate being allowed to cover the alveolar ridge.

On the lower jaw, if many teeth have been extracted, it is better to wait till the gums are healed ; but if the patient is desirous of having them at once, make them ; if the remains of the front teeth have just been removed, set, as in the upper, the necks of the teeth into the sockets. It is seldom possible to cover the outside of the alveolar ridge with the plate, without projecting the lip.

Injury comes to the ridge by wearing the temporary plates too long. It causes excessive absorption where it presses too hard, and is quite annoying. The patient should visit the dentist occasionally that changes may be made in the plate or grinding surfaces of the teeth, as the gums settle.

## CHAPTER XXI.

### ADJUSTMENT IN THE MOUTH.

**A**FTER the work is completed, be careful to adjust it in the mouth so as to leave as favorable an impression as possible.

If it is a clasp plate, see that the clasps spring into place so as to hold, and yet not be injuriously tight. See that the teeth are articulated in partial sets, so that the pressure is thrown on the natural organs.

In adjusting a full set the greatest care must be taken to see that the articulation is correct. Say to the patient: If you find the plate hurts you, call soon and have the pressure relieved, for it is not necessary to suffer; relief should be afforded at once.

It is advisable to see the patient in a few days, to be sure that the articulation is correct. Too much stress cannot be laid on this point.

"Articulating paper" is very useful to indicate when grinding is necessary. The ordinary black transfer paper will answer, although rather thin.

If there seems to be undue pressure at any spot on the hard palate, it may be located upon the plate, by spreading a little moistened rouge upon the spot and pressing the plate into place.

There are mouths where all the conditions are favorable, so that it is easy to secure results satisfactory to the patient as well as to yourself. There are mouths where *all* the conditions are unfavorable, and after the dentist has done all that care, skill, and experience can accomplish, the patient will complain, and wonder why the teeth do not work as satisfactorily as Neighbor Blank's. It is often because the conditions of the mouth are entirely different or unfavorable

to the best results. The only thing is to impress the importance of patience and constant use of the teeth. Time and perseverance will accomplish wonders.

A few hints may be given on the use of artificial teeth, as, for instance, in biting an apple; if the teeth are used as the natural teeth are, they are liable to be thrown down from behind. The new teeth must be pressed *against* in biting. In masticating, if the food is all placed on one side, the leverage is such that the plate is displaced; and yet, in time, the patient will learn to eat on one side; but at first divide, and with the tongue place the food on both sides.

## CHAPTER XXII.

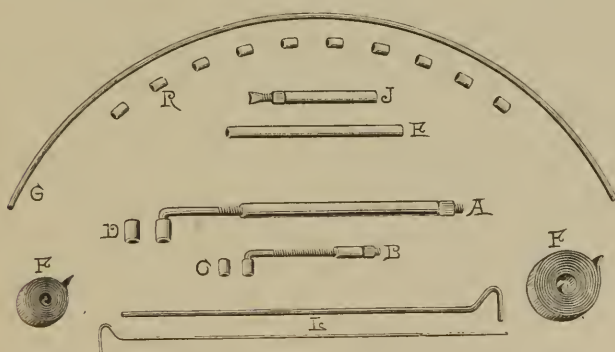
### THE ANGLE SYSTEM OF REGULATION AND RETENTION OF TEETH.

EDWARD H. ANGLE, D.D.S., PROFESSOR OF HISTOLOGY AND LECTURER ON  
COMPARATIVE ANATOMY AND ORTHODONTIA IN THE DENTAL  
DEPARTMENT OF THE UNIVERSITY  
OF MINNESOTA.

SINCE the publication of the first edition of this work, experience in the treatment of a large number of cases has resulted in the subjection of these appliances many times to the most severe tests. As a result of this, several modifications have been developed, both in the application as well as the proportions of the different parts, together with an entire change in the material from which the appliances are constructed. The little pipes were originally constructed from wire containing seams. They are now made seamless, which is an advantage.

It is believed that the set of appliances shown in Fig. 17 is very nearly faultless.

FIG. 17.



ANGLE'S APPLIANCES.

It is not my intention at this time to give a full and complete treatise on Orthodontia, but rather to give my own

method of accomplishing the different movements in the correct adjustment of malposed teeth, believing that most practitioners will succeed far better by adopting *one* method and thoroughly familiarizing themselves with the principles of the same, than they will by but a general understanding of the almost innumerable methods and appliances which have been brought out from time to time.

To those who wish to pursue the subject as to the Etiology, together with the history of methods and appliances in general, I would recommend the excellent works on the subject by Drs. Guilford and Kingsley.

In studying the construction and application of any system having for its object the treatment of dental irregularities, the fundamental principles will be more easily understood if we remember the movements of the teeth in regulating are limited to one or more of the following:

Forward in line of arch; backward in line of arch; from without, inward; from within, outward; rotation, and occasionally elongation or depression. The physiological principles governing all these movements are the same, so that by understanding the principles governing one, we may comprehend all.

In applying force to a tooth, it should be direct, and sufficient to accomplish the desired movement as rapidly as is consistent with the physiological law governing the absorption of bone in each case. This law varies so greatly with different individuals, and at different ages, that no fixed rate, or even approximate rate, can ever be established. The judgment of the operator must determine.

In no instance should the pressure exerted be great enough to occasion pain; if so, the normal rate of absorption is interfered with.

A very safe rule to apply, whether the pressure be constant or irregular, is to see that it does in no instance *exceed a snug feeling*. I am convinced that this feeling is the true indication of the proper amount of force.

Another very important principle which should always be borne in mind while performing the movements of a tooth is, that pressure should *never be wholly* relinquished.

The movement of a tooth may be arrested as often as necessary, but never allowed, by reason of removal of pressure, to spring backward, thus interfering with the process of repair.

I am convinced that disregarding this principle (as has usually been necessary in the ordinary regulating appliances, by the reason of the faulty principles on which their construction has been based, necessitating their frequent removal for purposes of modification and cleansing) has been the occasion of nearly all the pain and soreness in regulating.

The result of this in many cases has been discouragement on the part of the patient, and much annoyance and frequent failure on that of the operator. The movement of a tooth, if intelligently accomplished, should be painless.

Another very important principle to be remembered is, that support and perfect rest are essential to a tooth after it has been moved into the desired position.

Any appliance for retaining a tooth which necessitates its frequent removal should never be used. Again, a retaining appliance should be so delicate that it may be worn without inconvenience to the patient, until perfect firmness has been established, and should never be under the control of the patient. It may be needless to remark that a tooth so retained will become firm in its new position much more speedily than if subjected to occasional disturbances. It is believed the following system of treating dental irregularities enables the intelligent operator to easily fulfill the requirements so far enumerated.

In deciding upon a proper course of treatment in any given case, much care and judgment should always be exercised, beside a careful study of the features and the due consideration of the probable modifying effects of the proposed changes, the establishment of correct occlusion, etc.

A valuable assistant will always be found by first obtaining careful and accurate models of both jaws, and correctly articulating the same.

Such models not only assist in forming a basis for correctly establishing the proper line of operation, but are exceedingly valuable as reference during the whole course of treatment, for, from such models accurate measurements may be taken from time to time, and comparisons may be made with the teeth as the case progresses.

In this way we may not only judge of the exact speed of the moving teeth, but unfavorable movements of the anchor teeth may be detected.

In order that these models may be of any value they must not only accurately show the positions of the teeth and cusps, but they must also indicate the rugæ, gums and as much of the roots and positions of the same as is indicated by the shape of the gums and alveoli up to the point where the attachments of the muscles render obscure the further shape of the jaw.

From the large number of imperfect models that I have received from dentists, I am of the opinion that the value of correct models is not sufficiently appreciated.

After trying all kinds of impression materials and different methods of taking impressions, I am well satisfied that the best material is plaster,\* and it should be used as follows:

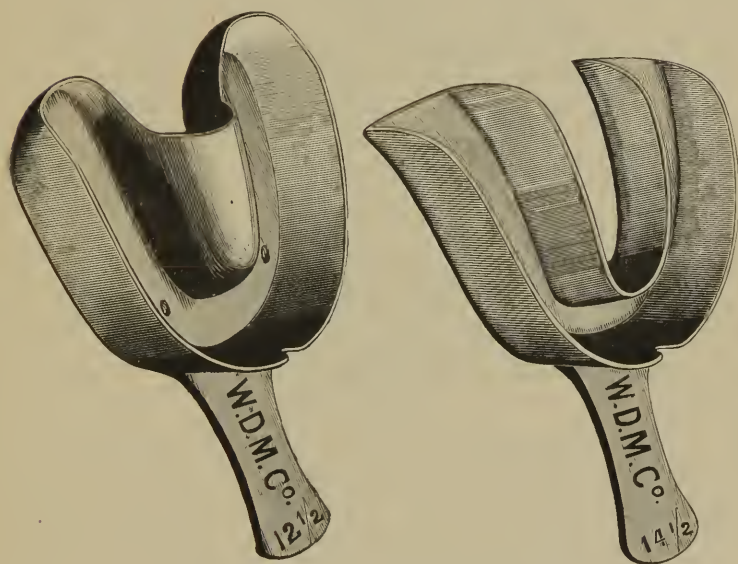
In the first place, the impression cups for sale at the different depots are all incorrect and ill adapted to the purpose of obtaining impressions of a jaw containing full dentures, for the reason that they are all intended for obtaining impressions of edentulous jaws. The rim of these cups, as well as the proportions covering the palatine process, are entirely too low; they should be much higher.

---

\* Since writing the above I have been experimenting with Teague's Impression Compound, a substance similar to plaster, which is probably in some respects superior.

By obtaining a few sizes of the cups designed by the author, as represented in Fig. 18, the difficulty of taking

FIG. 18.



IMPRESSION CUPS FOR IRREGULARITIES.

impressions high up or low down (depending upon whether it be the upper or lower jaw) is wholly obviated.

When a cup suitable to the case has been selected, it should be slightly oiled, or coated with a film of fine castile soap, which can be easily accomplished by moistening a small pledget of clean cotton in water, rubbing it over a piece of soap, and then over the cup. It is also well to coat the teeth in the same manner.

When the impression plaster has been mixed to the usual consistency, and distributed in the cups, nearly as it

should appear after the impression is taken, and the patient, provided with a clean towel about the neck, has been instructed to sit upright, the mouth is opened and the cup inserted. The head should be somewhat thrown forward to prevent the plaster from falling into the throat. The cup should be pushed up first at the heel, then the lips raised, and the anterior part of the cup forced well up into position; then the lips should be drawn down over the edge of the cup, and a slight pressure exerted from the outside in order to force the plaster well up against the muscles. The plaster should be allowed to become hard and *thoroughly set*, after which the cup and all surplus pieces of plaster should be carefully removed, leaving the impression still in the mouth. With a blade of a penknife cut two grooves in the impression, the positions of the grooves being parallel to the lines of axes of the cuspid teeth. These grooves should be quite deep, but not entirely through the impression to the gums or crowns.

This being done, the point of the penknife should be inserted in one of the grooves, and with a quick pry, the external plate of plaster between the grooves is readily removed. The plates at the sides can now be readily broken outward between the thumb and finger, the line of fracture will follow the cutting edges of the teeth, then the large piece of plaster covering the roof of the mouth is readily worked loose and removed in one piece.

If the operation has been carefully performed, the impression will consist of but four pieces.

After drying a few moments, they are readily replaced in their proper positions, in the order in which they were removed, and secured by wax, or, better still, moistening the edges of the fracture with celluloid dissolved in ether, as suggested by Dr. Van Duzee. *Never attempt to re-unite the pieces by placing in cups.*

The impression should now appear as shown in Fig. 19.

FIG. 19.



IMPRESSION RE-UNITED.

Not later than one-half hour after the impression has been taken, the inside should be thoroughly coated with shellac varnish; at the expiration of another half hour, again coated with sandarac varnish, and at the end of still another half hour, it should be very carefully filled with plaster and turned upside down on a glass slab.

After the plaster is thoroughly set, the pieces of the impression may usually be readily separated in the same order in which they were removed from the mouth.

The model can now be trimmed, and not only will there be a surface as smooth as the most finely polished marble, but each cusp, and all the interdental spaces, as well as the rugæ, and even the minute "stipples" of the gum will be most accurately and beautifully shown. The models should now be neatly labeled, and will serve all the purposes of study and reference already enumerated.

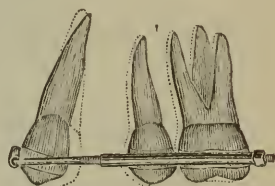
We now come to another most important principle,

which should be remembered in the movement of a tooth; that is, that correct or stationary anchorage should be secured.

Teeth that have been selected as anchorage should be attached to in such manner that tipping and consequent movement would be impossible, or if movement of such a tooth does take place the anchorage should be so rigid that the tooth must be dragged bodily through the alveolus, the apices of the root moving fully as much as the crown.

This principle is well illustrated in Fig. 20, in which the anchor-teeth are banded, and a pipe or sheath through which the screw pulls is rigidly attached by means of solder, as the bands on the anchor-teeth are firmly cemented. It will be seen that perfect anchorage is established and consequent tipping of the same is thereby rendered impossible.

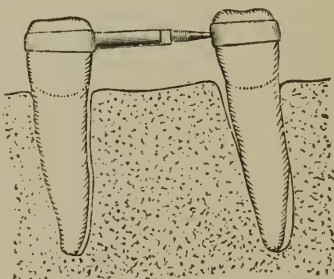
FIG. 20.



STATIONARY ANCHORAGE.

The dotted lines in the diagram indicate the movements which must take place. Fig. 21 shows the same principle where the motion is pushing instead of pulling. The base of the jack-screw in this case is soldered to the band.

FIG. 21.



LATERAL MOVEMENT.

It will be readily comprehended how greatly anchorage is increased over the old method, when advantage is taken of this method of anchorage.

Figure 17, Angle's Appliances, shows the simple appliances from which all the various combinations used in the method may be made. "A" is a large traction screw increased in its accompanying tube, and used for pulling where the resistance is great. "B" is a smaller traction screw, used in the same way where the resistance is slight, or where from any reason a delicate appliance is desired. "C" and

"D" are tubes which are soldered to bands placed upon the teeth to be moved, into which the ends of the traction screw are hooked. "J" is a jack screw, used for pushing, the end of which is beaten flat. "E" is an extra piece of tubing, by means of which a longer jack screw can be made. "F" are coils of band material. "G" is a gold wire used in retaining the teeth after they have been moved into the desired positions; also, to assist in securing an anchorage in some cases; and "R" are small retaining tubes designed to be soldered to bands into which the retaining wire accurately fits. "L" are piano-wire levers of varying sizes, giving different degrees of power.

It will thus be seen that the appliances are very simple, and few in number, they being limited practically to three, viz.: the lever for rotating, the screw for pushing, and the traction screw for pulling, the other pieces being for the purpose of securing attachments, and, aside from the advantages of simplicity, efficiency and cleanliness, stationary anchorage, non-relinquishment of pressure, and firm retention may be easily accomplished by their intelligent application.

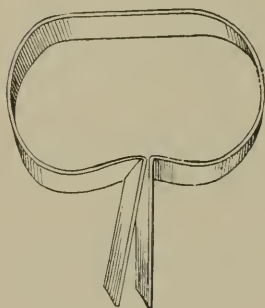
As it will be seen that the Magill band (Fig. 22) plays an important part in attaching the different parts of the appliances to the teeth, I will here describe the quickest, easiest, and most accurate way of making and setting these bands.

First, the rubber dam should be slipped over the tooth to be banded, and at least one more on each side, and it is usually better to include all the teeth to which the appliance is being adjusted. The surface of the tooth to be banded is then carefully cleansed by means of a pledget of cotton moistened in alcohol or ether. A loop of the band material is then slipped over the tooth.

I prefer German silver to any other metal, on account of its great strength; it may be rolled to extreme thinness, thereby occupying a small amount of space. The ends should now be grasped close to the tooth with a pair of closely-fitting, flat-nosed pliers, and the band drawn tightly

around the tooth, a strong burnisher being applied at the same time, to make it conform still further to the shape of the tooth; remove the band, which now presents the appearance shown in Fig. 22. Place a small bit of silver or gold

FIG. 22.



MAGILL BAND.  
(Greatly Enlarged).

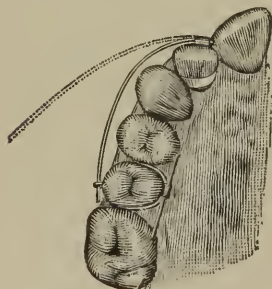
solder and borax at the junction, and carry the band in contact with the flame of the soldering-lamp. After it is soldered, clip the ends off, and the band is now ready for any attachment which may be made; after which it is cemented in position on the tooth, being gently driven to place by means of a foot-shaped plugger and small mallet.

If the teeth are firmly crowded together, space may be gained for the band by forcing first a thin spatula between them.

We might illustrate, without limit, the different ways of attaching and operating these appliances in accomplishing the movements of the teeth; but sufficient number of the many modifications of which they are susceptible is here shown to enable the average operator to become sufficiently familiar with them to treat all ordinary cases.

The movements of rotation of a tooth is accomplished by means of the lever shown at "L," Fig. 17. The tooth is banded in the manner already described.

FIG 23.



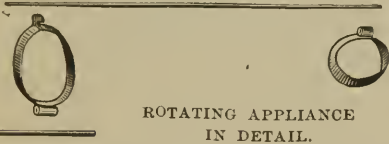
ROTATION.

One of the small pipes, "R," Fig. 17, is soldered to the buccal surface of this band, and the band cemented in position upon the tooth; one end of the rotating lever is inserted into the pipe; the other is sprung around and latched into a hook soldered to a band encircling a suitable anchor tooth. Fig. 23 shows a lateral in-

cisor while being rotated by this appliance. It will be seen that a powerful and constant force is being exerted upon the tooth to be moved.

It will also be noticed that the anchor-tooth is re-inforced by a piece of the gold wire, "G," Fig. 17, passing through a pipe soldered to the lingual surface of the band; the ends of the gold wire resting upon the lingual surfaces of the first bicuspid and molar. The appliance is shown

FIG. 24.



in detail in Fig. 24. After the tooth is in proper position, it is retained by means of a short piece of the gold wire, which

passes through the tube, and extends upon the central, as seen in Fig. 25. This wire is kept in place by a small pin, which is tightly fitted in a very small hole drilled through both tube and one side of the wire, as shown. Fig. 26 shows

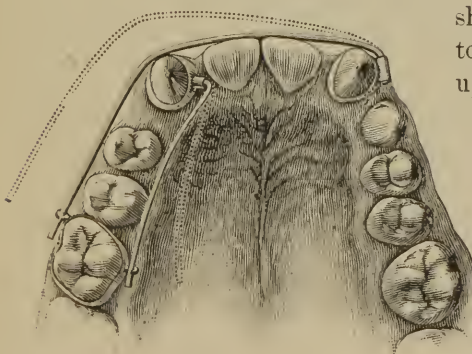
FIG. 25.



two powerful cuspid teeth while being rotated by this method. It will be seen that the lever may be applied with an equal effect upon either the inside or outside of the arch, and in this

case one anchor tooth is made to serve as anchorage for both levers. It is necessary to exercise care and judgment in the use of the powerful levers.

FIG. 26.



ROTATION.

First, the lever should not be allowed to touch at any point upon the teeth intervening between the tooth being rotated and the anchorage, lest the moving tooth be pried outward; second, care should be taken that the movement is not

accomplished more rapidly than the absorption of bone takes place, otherwise the tooth will be sprung outward by reason of the external plate of the alveolus which, being thinner, offers less resistance, and will be gradually bent outward.

FIG. 27.



DOUBLE ROTATION.

When the teeth are to be rotated in opposite directions at the same time, as the central incisors, shown in Fig. 27, double rotation may be accomplished by one appliance. Both the teeth are banded, and a tube soldered to each band; one being horizontal and the other vertical. A piece of the lever "L," Fig. 17, is bent at right angles at one end, and then sprung into position, as seen in Fig. 28. The tendency of the

FIG. 28.



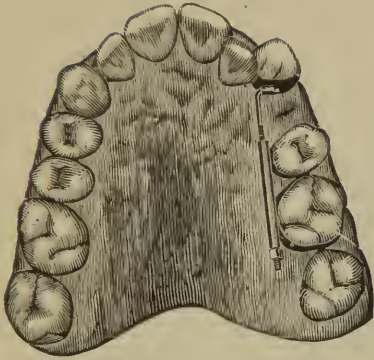
DOUBLE ROTATION.

wire to straighten itself will rotate both teeth at once. Recent experience has shown that a better way of applying the lever is to attach *both* pipes horizontally, using a straight lever, springing and sliding it into the last pipe in the same manner in which a bolt is slid in position in fastening a door.

The piano wire used in making this lever should never be heavier than No. 13, German. *Heavier will not do.* It may be necessary to occasionally remove and straighten the lever a little, in order to maintain the pressure. Should one tooth be rotated sufficiently before the other, further movement may be arrested by removing the band and soldering a lug on the lingual surface, resting against the lateral incisor. When in position, they are retained by substituting a piece of the non-elastic gold wire, "G," Fig. 17, for the spring wire.

The backward movement of teeth in the line of arch is accomplished by the appliance shown in Fig. 29. The first molar is banded in the usual manner, and the tube of

FIG. 29.



RETRACTION OF CUSPID.

the heavy traction screw, shown at "A" Fig. 17, rigidly soldered to the band. The cuspid to be moved is banded, and one of the short tubes, shown at "D" Fig. 17, is soldered to the band to receive the large traction screw, "A" Fig. 17. On turning the nut, traction is produced and the cuspid pulled or tipped into place. Fig. 20

shows a side view of the same.

The screw may be applied either upon the out or inside of the arch, and should the cuspid also require to be drawn into the line of arch, as well as backward, it may be accomplished at the same time, by bending the screw at the point where it enters the long pipe. It will gradually draw into the pipe as the tooth is moved back thereby accomplishing both movements.

The easiest way to adjust this appliance is to first cement the band upon the cuspid tooth. After the cement has become thoroughly set, the angle of the traction screw is hooked into the pipe, and the other band is now latched over the molar. The greatest care should be taken to make this attachment accurate, using the strongest cement.

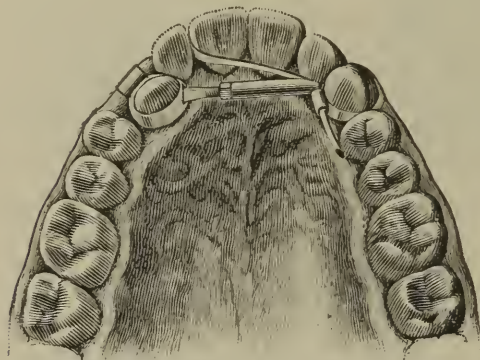
The nut should never be tightened enough at one time to strain the attachment. After the tooth is moved back, it is retained by the screw already in position, or that may be removed and a piece of the gold wire be inserted in its place.

The movement of a tooth forward in the line of arch is accomplished in the same way, only selecting teeth from the

opposite side to be used in overcoming the resistance of the teeth which are being moved.

The movement of a tooth from within, outward in the line of the arch, is shown in Fig. 30, and is accom-

FIG. 30.



RE-INFORCED ANCHORAGE.

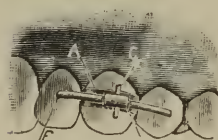
plished by the jack-screw "J," Fig. 17. A firm anchorage for the resistance of the screw is obtained by banding and tubing the left cuspid and passing through the tube a piece of gold wire, long enough to extend to and rest against the

adjoining teeth. The opposite cuspid to be moved is banded and a retaining tube, "R," Fig. 17, is soldered to the labial surface.

The lingual surface has a slot cut in it to receive the flat end of the jack-screw; the other end of the tube, in which the screw plays, is so notched with a file that it rests securely against the re-inforcement wire, and the tube against the lingual surface of the cuspid band.

Movement is accomplished by tightening the nut.

[FIG. 31.]

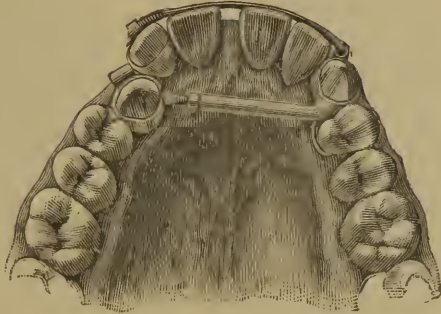


RETAINED.

After being brought into position, the tooth is retained by passing a short piece of the gold wire through the retaining tube on the labial surface, as shown in Fig. 31, which is held in place until the tooth has become firmly set in its new position.

Fig. 32 shows a cuspid tooth being moved outward. The base of the jack-screw is soldered to a band encircling the opposite cuspid, and re-inforced by a spur, resting against the first bicuspid, and also by the large traction screw which is hooked into a pipe, soldered to the labial surface of the band, and passing in front of the incisors through a tube, against which the nut works, soldered to a band on the labial surface of the lateral incisor.

FIG. 32.

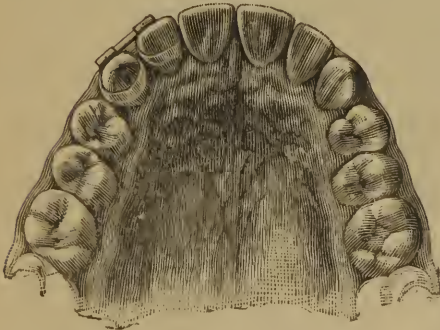


OUTWARD.

In this case, the left central and lateral were moved forward in the line of arch, thereby closing the space between the centrals, and, at the same time, providing space for the out-moving cuspid. The large screw was beaten flat and polished before insertion.

Fig. 33 shows the same case after completion. Another

FIG. 33.



CASE AS COMPLETED.

method of securing resistance for the base of the jack-screws, in accomplishing the outward movement, is shown in Fig. 34, where two central incisors are being forced out of in-lock, pipes were soldered to the palatine sides of bands, encircling the second bicuspids; the

ends of a wire arch were slipped through these pipes,

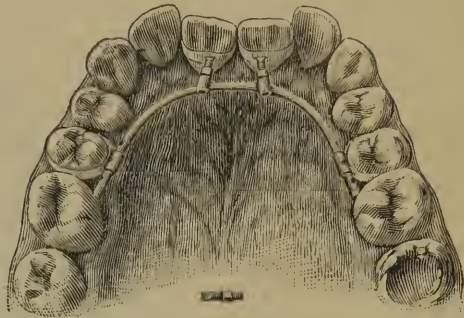
and rested against the molars. Two short pipes were soldered to the wire arch, opposite the teeth, to be moved in lines corresponding to the direction of the movement.

Two jack-screws were slipped into these pipes, the flat ends of the same were inserted in slots formed in the lingual sides of the bands encircling the teeth to be moved. The screws in this case were only one-fourth of an inch in length. After the nuts on the screws had traveled the length of the threads, they were again screwed back, and the wire arch moved forward and keyed into position by delicate pins, passing through holes in the pipes on the anchor teeth, as shown in the engraving. (The pipes into which the jack-screws rest should have been represented as being soldered to the upper side of the wire arch, instead of the lower, as shown in the engraving.)

Another method of re-inforcing the anchorage in moving a tooth outward is shown on the right in Fig. 35.

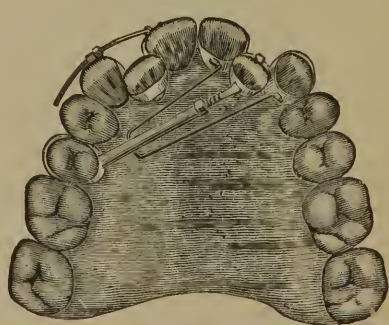
The second bicuspid is made the principal anchorage against which the base of the tube is soldered. The band encircling the lateral incisor has a slot cut in it to receive the end of the jack-screw. The anchorage is re-inforced by means of a wire loop which hooks into tubes upon the adjoining central and cuspid, and

FIG. 34.



THE ARCH AS ANCHORAGE.

FIG. 35.



INCREASED ANCHORAGE.

is looped over a spur upon the body of the jack-screw tube.

The central and cuspid cannot be pushed outward on account of this re-inforcement, and the three teeth constitute the anchorage instead of one. The several parts of this appliance are shown at Fig. 36. Outward movement is accomplished by another simple method, shown on the left of Fig. 35, as follows: A strip of band material shown at "F," Fig. 17, is looped about the malposed tooth, the ends resting upon the labial surfaces of the adjoining teeth.

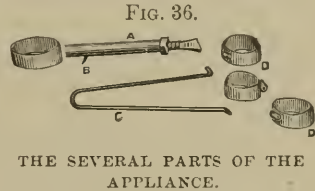


FIG. 36.  
THE SEVERAL PARTS OF THE APPLIANCE.

To one end of this strip is soldered a tube "C," Fig. 17, placed vertically, while to the other end a similar tube is attached horizontally. Into these tubes the small traction screw "B," Fig. 17, is placed, being bent to conform to the shape of the arch, and being used in this case to push instead of to pull.

The parts of this device are shown separately at Fig. 37. Fig. 38 shows the teeth retained after the case was completed. Expansion of the arch is accomplished by banding and tubing the first and last teeth of those to be moved, on each side, and connecting them by means of steel wire passing through the tubes.

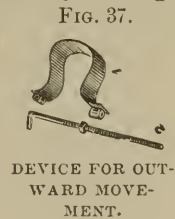


FIG. 37.  
DEVICE FOR OUTWARD MOVEMENT.

The jack-screw is then placed in position across the arch from wire to wire. Collars or short tubes are soldered to the wires at intervals to keep the screw in proper position. These collars must be attached by soft solder, that the temper of the steel wire may not be disturbed. The jack-screw may be moved forward or backward according to the varying requirements of the case.

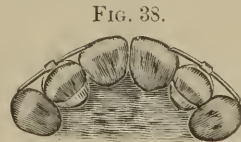
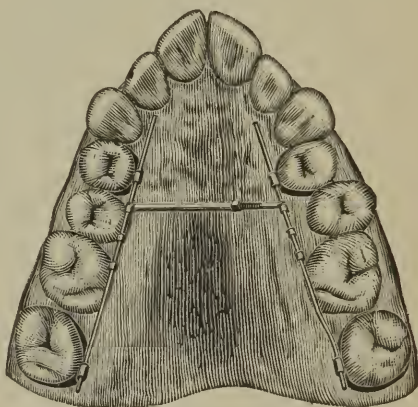


FIG. 38.  
RETAINED.

Before placing in position the wires which pass along the sides of the arch they should be bent to correspond to the shape of the sides of an ideal arch, or exactly as we wish the teeth to be arranged after the desired position is gained. The appliances in position are accurately shown in Fig. 39, with the exception that the tubes attached to the *posterior* bands should be nearly perpendicular instead of horizontal.

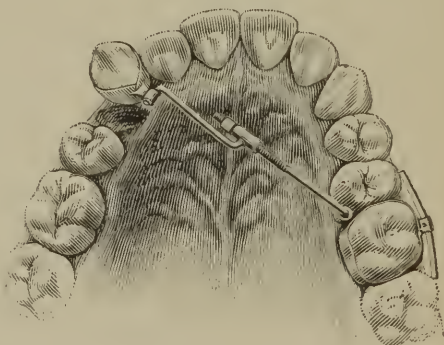
FIG. 39.



EXPANSION.

The movement from without, inward into the line of the arch, may be accomplished, as shown in Fig. 40. The cuspid tooth is banded and a piece of the gold wire bent sharply at right angles hooked into a pipe, soldered to the lingual surface. The other end of the wire is soldered to a pipe through which the small traction screw is slipped and against which the nut works.

FIG. 40.



INWARD.

The other end of the traction screw is hooked into a pipe soldered to a band encircling the first molar. The anchorage of this tooth is further re-inforced by a piece of the gold wire, which is slipped through a tube soldered to the buccal surface of this band,

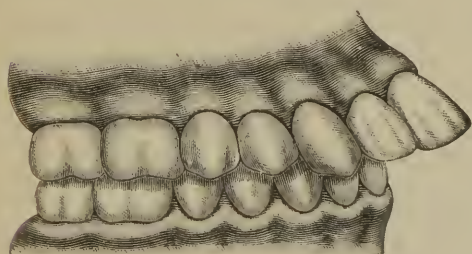
the end of the wire resting against the adjoining teeth. Retention is accomplished in a manner similar to that shown in Fig. 38.

Another very nice method of gaining anchorage for the small traction screw in drawing teeth inward into line of arch is illustrated in Fig. 34, using the wire arch to pull to, instead of pushing from, as illustrated.

In using the traction screw in this way, it should be, of course, cut very short, so that the movements of the tongue may be interfered with as little as possible; and if the tongue be abraded by the end of the screw as it emerges from the nut, a very nice way of protecting the tongue, as in all similar cases, is for the patient to lay over the end of the screw a small piece of the very common article known as chewing gum.

With the above appliances, any form of irregularities may be treated. There is one form, however, characterized by excessive prominence of all the superior teeth, and illustrated by Fig. 41, in which the force required for mov-

FIG. 41.

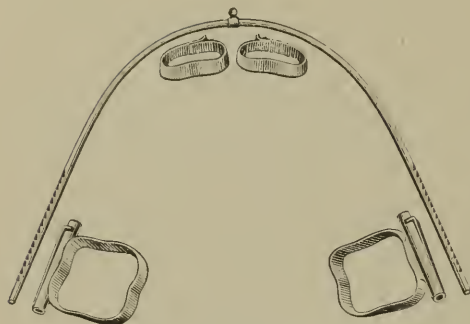


EXCESSIVE PROTRUSION.

ing backward all of these prominent teeth is usually too great to be borne by the posterior teeth as anchorage; and, owing to this insufficiency of anchorage, the usual result is that the molar teeth

are frequently tipped forward, and faulty occlusion established, without accomplishing the desired result. On this account I have devised an appliance to be used in these special cases, the anchorage of which will be transferred to the back of the head by means of the occipital bandage. It is known as Appliance No. 2, and shown in part in Fig. 42. It is

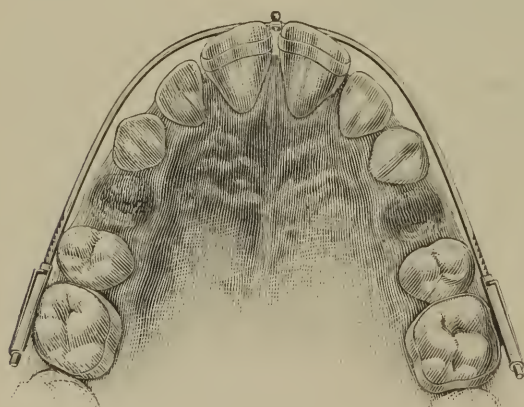
FIG. 42.



PART OF ANGLE'S APPLIANCE NO. 2.

made and applied as follows: The first molars are carefully and accurately banded. Pipes,  $\frac{5}{8}$  of an inch in length, are soldered on the buccal surface of the bands, on a line parallel with the gum. A wire of hard-drawn, platinized gold, about No. 19 gauge, and long enough to encircle the dental arch, and carefully bent to conform to the shape of the same, *provided* the dental arch to be correct in form; but if it be contracted and the teeth occupy irregular positions, no attention is paid to the form of the existing arch, but an ideal arch is formed for the case; or, in other words, the wire arch is bent to exactly the form to which we wish the teeth to be arranged when the operation is completed. The ends of the ideal arch are now slipped through the pipes on the molars. The anterior part of the arch is kept from slid-

FIG. 43.



APPLIANCE NO. 2 IN POSITION.

ing up and impinging upon the gums by resting in suitable notches formed in the delicate bands encircling and cemented to the central or lateral incisors. It is shown in position upon the teeth in Fig. 43.

Fig. 44 represents a traction bar used for conveying the

FIG. 44.



TRACTION BAR.

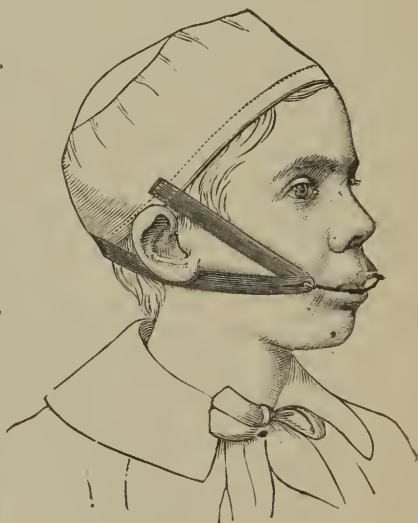
force from the occipital bandage and distributing it to the wire arch. A spur or standard will be seen in the center of this bar, provided with a socket in the end, which, when in position, engages a small ball soldered to a delicate tube encircling the center of the wire arch, as is shown in Fig. 40. If the reader is familiar with the appliance so far described, it will be seen that the force received from the occipital bandage is distributed to the wire arch through the ball and socket joint. The ends of the traction bar may, therefore, be moved in any direction without interfering with the pressure from the bandage. The advantage of this attachment is that, in consequence of the freedom of motion, any jar or shock upon the traction bar will not be transmitted to the tender teeth. As the bandage and bar are to be worn only at night, shocks from contact with the pillow would be very liable to occur and occasion much pain, were it not that the bar is provided with this freedom of movement. This is a point of advantage which I think all will appreciate, and one possessed by no other device with which I am familiar. The usual method is to attach the traction bar, or its equivalent, to a swedged or vulcanite cap covering, and firmly resting against all the teeth to be moved.

As the heavy rubber ligatures of the bandage act during the night only, provision must be made to hold through the day what is gained at night. This is accomplished by the spring-dogs attached to the pipes, fastened to the bands encircling the anchor teeth, catching into the delicate notches in the wire arch, as they pass through the pipes, as shown in Fig. 43. This effectually prevents the loosened teeth from

springing back and interfering with the healing process. Another advantage of the device is, that not only the prominence of the teeth is reduced, but teeth that are irregular are gradually forced to take regular positions and conform to the shape of the ideal arch; something impossible with devices having fixed caps of vulcanite or gold. Still another advantage is, that if the arch needs expanding, as is frequently the case, it may easily be accomplished at the same time the teeth are being moved backward, by lacing to the wire arch such teeth as need to be moved outward.

For the bandage proper, I greatly prefer the common silk traveling cap, shown in the engraving, or the knit jersey cap, to the contrivances usually used for this purpose, as these fit the head snugly and distribute the force exerted by the strong ligatures over more surface, and are, consequently more easily worn. Two ligatures should be attached to the cap, on each side, one above the ear, and one below the ear, as shown in Fig. 45. If the bands be of equal width, the force will be exerted in the direction of the meatus of the ear. This is the point to which, in most cases, the force should be directed. In some cases, however, the teeth should be compressed in their sockets as well as drawn backward. This is easily accomplished by dispensing with the ligature below the ear, using the upper only, but of double strength, attaching it at a point on the cap as far forward as desired.

FIG. 45.



OCCIPITAL ANCHORAGE.

After the teeth have been moved into the desired position, they are effectually retained by the wire arch, and the head gear and traction bar are, of course, dispensed with. Extra care as to cleansing the teeth should be observed by the patient while wearing this, as well as all other appliances.

The traction bar and bandage may also be used to great advantage in the movement of single teeth, or in assisting other appliances, as for example a single prominent incisor, encircled by a band, on the labial surface of which has been soldered a ball which engages the socket in the spur of the traction bar. Or a cuspid may be moved backward in the same manner; but in this case, the spur should be moved from the center towards the end of the traction bar, and the ligatures attached to the long end of the bar should be of less strength.

The bandage and bar may be used to assist the appliances shown in Figs. 27 and 28, in double rotation. Should these teeth begin to show undue prominence as they rotate, by reason of pressure from the adjoining teeth, the bar and bandage, applied for a few nights, will effectually remedy this annoyance. It may also be used to advantage, in the same manner, in assisting the lever in single rotation.

Other appliances of this bandage and bar might be given, but they will suggest themselves to any one in whose hands the appliances may be.

## CHAPTER XXIII.

### FRACTURES OF MAXILLARY BONES.

IN the treatment of fractures of the jaws the all-important principle, after securing perfect apposition of the parts, is that they shall have rest—absolute, uninterrupted rest. But, owing to the vast number of movements to which the inferior maxilla is susceptible in health, and the many causes tending to produce these movements, it becomes extremely difficult to secure the requisite amount of rest to enable nature to effect the needed repair.

Dr. Norman Kingsley has well said, “Of all the fractures the surgeon is called upon to treat, there is more difficulty in the management of those of the inferior maxilla than those of any other bone.” And Dr. Charles G. Brown makes a statement in the *Medical Record* of October 6, 1889, which it is well to remember while considering this subject. He says: “In the treatment of fractures of the inferior maxilla, as in fractures of all other bones, our success is in direct ratio to our recognition and antagonization of the physiological contraction of muscles, restoring the lost balance of action, and thereby securing rest in proper position.”

Now in order to solve the problem of securing rest, almost innumerable devices are used.

Some of these are extremely complicated, difficult to make and to apply, and many of them extremely cumbersome and annoying to the patient, and, owing to the faulty principles on which they are constructed, accuracy and certainty of correct results are only probable, and with many of the appliances, impossible.

In treatment of fractures of the maxillary bones, I shall divide the subject into three classes.

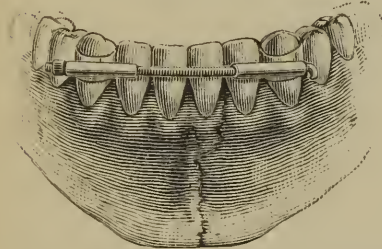
The first class comprises all cases of simple fracture in which the teeth are good, especially on each side of the region of the fracture. They should be sufficiently sound and firm in their attachments to afford good anchorage for the appliance which supports the fracture.

The second class comprises all fractures where the teeth are unsuited, from any cause, for anchorage, but sufficient to give a correct articulation of the jaws when they are in proper occlusion.

The third class comprises all fractures of jaws which are edentulous.

In Fig. 46 is illustrated the device used in the treat-

FIG. 46.



REDUCING FRACTURE WITH ANCHOR SPLINT.

ment of fractures of the first class, and a description of the case as treated by myself will be sufficient to convey an idea of the line of treatment.

May 29, 1889, Nels Peterson, aged twenty-one, was admitted to St. Anthony Hospital, of this city. He had fallen from a lumber pile fifteen or twenty feet to the ground, and, besides receiving severe bruises, had sustained a simple fracture through symphysis, terminating however, in front, between the central and lateral, on the left side, as shown by the line in the engraving.

The fractured bone, when first seen, was quite widely separated at the top, and the left central incisor much loosened. He was treated as follows:

The ends of the fractured bones were carefully placed in their proper positions and temporarily fastened by lacing the teeth together with silk ligatures.

The cuspid teeth, being very firm, were carefully banded in the manner already described on page 75. Pipes were soldered to these bands horizontally. The large traction

screw shown at "A," Fig. 17, was now slipped through the pipes, and the bands firmly cemented in position upon the teeth. The nut was then turned upon the screw until the fractured ends of the bones were drawn snugly together.

This appliance was worn without displacement or further trouble for twenty-one days, when it was removed, the bones having become firmly united. I may add that, during the time the appliance was worn, so firmly was the jaw supported that the patient suffered but little inconvenience, and after the third day partook regularly of his meals, using his jaw freely, but, of course, avoiding the hardest food.

After removing the appliance, a careful impression of the jaw was taken, a model made, and the appliance placed upon it, from which the engraving here figured was made. The lower part of the jaw is, of course, diagrammatic, as added by my engraver.

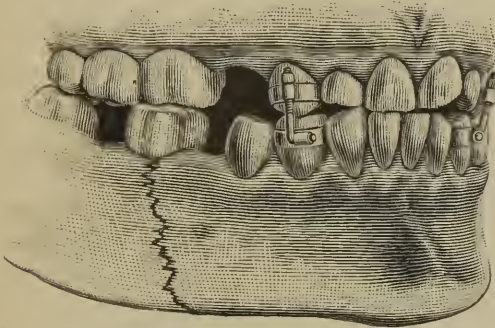
It should be borne in mind that the principle on which this appliance is based is not the same as when the teeth are simply wired together, but very different, for, in wiring, the upper part of the fracture only is tipped or drawn together, while no pressure or support is given to the lower part. While in the principle here shown it will be seen that because the bands and pipes are rigidly attached to the anchor-teeth tipping is impossible, and pressure is exerted equally on the lower and the upper part of the fractured end of the bones, since they are drawn together by the screw.

This is another illustration of the correct anchorage described on page 74, or, as a friend remarks: "It is a Malgaigne splint, if you please, except that the hooks are not foreign bodies." This device may be applied in any locality in either jaw, provided suitable teeth for anchorage be not too remote from line of fracture.

The screw may be bent to accommodate the curve in the jaw, should the fracture occur in the region of the cuspids.

The treatment for cases of the second division may be understood from the following case, also treated by myself, and illustrated in Fig. 47.

FIG. 47.



REDUCING FRACTURE BY ARTICULATION.

On July 14, 1889, Wm. Fraley, aged 45, was admitted to the Minneapolis City Hospital. A blow from a policeman's club had produced two simple fractures of the inferior maxilla. The first was an oblique fracture on the right side, beginning with the socket of the second bicuspid, extending down and backward, and involving the socket of the first molar. The second bicuspid had fallen out, and the first molar was much loosened. The second molar had been lost years before, while the third molar, as well as all the remaining teeth, were much abraded and loosened by salivary calculus.

The second fracture was situated on the opposite side, high up in the ramus of the jaw. I could not detect the exact course the line of the fracture had taken, but the grinding of the ends of the bones and the great pain occasioned by the same were unmistakable evidences of a fracture. The patient, as is usual in all such cases, was unable to close his jaws.

The fracture on the right side was widely separated, and the anterior piece much depressed by reason of the action of the digastric muscle.

The posterior piece of bone being drawn firmly up and the molar teeth occluding by reason of the contraction of the masseter muscle, he was treated as follows:

Bands were made to carefully encircle all four of the

cuspid teeth (they being most firmly attached in their sockets). The fractured ends of the bones were placed in careful apposition, and the lower jaw closed carefully, antagonizing the lower teeth with the upper, using considerable force, however, and occasioning so much pain that anæsthetizing the patient became necessary. The points on the bands, where the little pipes shown in the engraving should be attached, were carefully noted and marked. The bands were slipped off, and the pipe soldered to the same. The bands were then cemented in their proper position upon the teeth, and two small traction screws, shown in the engraving, and also at "B," Fig. 17, inserted in the little pipes. The jaws were closed and the nuts turned on the screws until the jaws were drawn firmly together, and each tooth occupied its exact position. During an attack of coughing in the night following, one of the bands was wrenched loose, but was easily replaced, the next day. No further accidents or trouble occurred, the patient readily taking nourishment through the spaces between the teeth. Thus the fractured jaw was firmly supported, without the least motion, for twenty-two days, when the appliance was removed, showing most excellent results.

That the patient was a great lover of the clay-pipe is shown in the engraving, by the much-worn ends of the lateral incisors, which resulted from holding the stem of the pipe. While wearing the appliance he was not debarred from his favorite comfort. He was, however, compelled to grasp the stem between the lips, instead of the teeth.

Case No. 3 possesses several points of special interest, although the fractures occurred in regions similar to the case just described; and the appliances, though involving similar mechanical principles, will be found to be greatly simplified.

December 28th, Thomas Brennan was admitted to the Dental Infirmary of the University of Minnesota, suffering from the effects of a blow received on the left side of the jaw from a cant-hook, while working in lumber camps of

Wisconsin, which produced fracture of the jaw in two places. The first fracture was on the left side, beginning between the first and second bicusps, and extending downward and backward so far as to involve the lower part of the anterior root of the first molar. The second fracture was on the right side, directly through the angle of the jaw. The fractures had occurred thirty-two days previous to his admission to the infirmary, during which time nothing had been done to reduce the fracture. He reported that he had called upon a physician, who supposed the trouble was merely an abscessed tooth, and had lanced the gum with the view of reducing the swelling. Later, the patient had called upon a dentist in one of the smaller towns, who also failed to diagnose the fracture, and extracted both bicusps in the hope of giving relief.

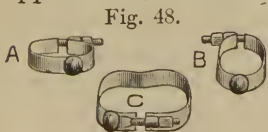
Upon examination, I found considerable swelling in the region of this fracture, with the usual result; the patient being unable to close his mouth by reason of the anterior piece of the fractured bone being drawn down by the contraction of the depressor muscles. A false joint had also become established. The bone could be easily worked without causing pain. At the fracture of the right side, there was little or no displacement; the swelling was also slight. With the assistance of Prof. Leonard, the patient was anesthetized; the ends of the bones were then rubbed forcibly together, with a view of breaking up the false attachments and stimulating activity in repair.

The ends of the bones were now placed in perfect apposition, and the jaw closed, taking great care to articulate the teeth in their correct position against the upper ones.

The jaw was now firmly bound in this position to the upper teeth, in the same manner as described in case No. 2,

only that method was improved upon by using *clasp bands*, as shown in Fig. 48.

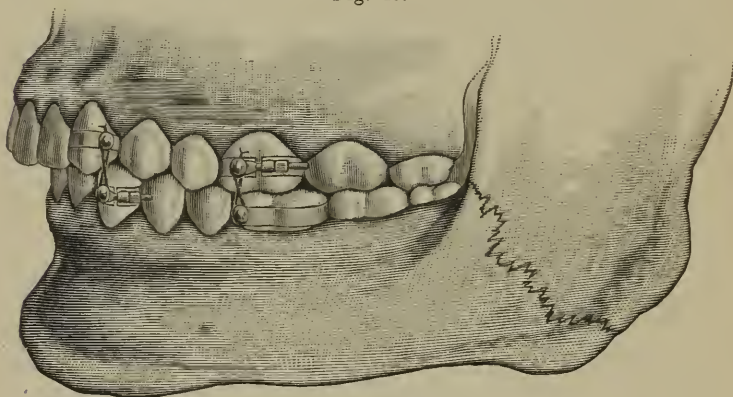
No cement was necessary; and,



ANGLE'S FRACTURE BANDS.

instead of the screws, small metallic buttons were soldered to the sides of the bands (as shown in the cut), around which were wrapped, in the form of the figure 8, fine binding wire, as shown in Fig. 49.

Fig. 49.



FRACTURE REDUCED.

Four bands were used encircling the four cuspid teeth. Those bands shown upon the molar teeth in the engraving were not used, but are shown for the purpose of illustrating their use in such cases as might occur. At the end of seventeen days, the bands were removed and the patient discharged, the bone having been firmly united.

It might be urged, as an argument against this method, that the teeth being closed, and the jaws being firmly bound together, the patient would be unable to take sufficient nourishment. This, however, is untrue; for it rarely happens that a patient is found without some teeth missing, thereby leaving abundance of space for the passage of the liquid foods; and, even if all the teeth were sound and in perfect position, it has been proven there is plenty of space between the teeth, and behind the molars, and between the upper and lower incisors, for taking all nourishment necessary. Of course, in such rare cases, much more time would be necessary in taking nourishment.

With suitable sized bands of this style almost any one could readily reduce in a few minutes a fracture belonging to this class, and in cases where crowding of the teeth renders difficult the slipping of the band between the teeth, space may be made by forcing a thin spatula between the teeth for a few minutes.

The third class, comprising fractures of edentulous jaws, is fortunately very rare. The method of treatment I propose is similar to that already described in the first class. The appliance to be used is based upon practically the same principle; only in place of the teeth small bone hooks are used, drilling for their reception a suitable cavity on each side of the fracture, comparing in position to the original sockets of the teeth, the same as implanting were intended, only the cavities thus made need not be nearly so large or deep. They should also be drilled obliquely, to correspond to the course taken by the bony hooks. The hooks, before insertion, should, of course, be made antiseptic.

In conclusion, I may add that the extreme simplicity and great efficiency of this system of treating fractures, together with cleanliness and comfort to the patient will, I believe, be appreciated by all who are interested in this branch of dental surgery.

EDWARD H. ANGLE, D. D. S.,

13, 14, 15 Syndicate Block,

February 5, 1890.

Minneapolis, Minn.



SURGEON GENERAL'S OFFICE

LIBRARY

Section

No.

Form 113c  
W.D., S.G.O.

U. S. GOVERNMENT PRINTING OFFICE, 1928

